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(NASA-CR-117701) LANGLEY 8 FOOT TPT WIND
TUNNEL TESTS /PROJECT 233/ OF APOLLO MODEL
/FD-2/ DATA REPORT, 3-8 MAY 1962 (North
American Aviation, Inc.) 49 p

N79-76101

Unclassified
00/02 11545

SID-62-1065

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DATA REPORT FOR Langley 8 FT. TPT
WIND TUNNEL TESTS (PROJECT 233) OF
APOLLO MODEL (FD-2)
NAS 9-150

(U)



4.S.5.1

24 August 1962

To: UNCLASSIFIED
By authority of C. Shirley
Changed by C. Shirley
Classified Document Control Station, NASA
Scientific and Technical Information Facility
Approved by D. J. Gindea - Manager
Flight Technology

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FOREWORD

The tests described herein were conducted under NASA Apollo contract NAS 9-150, during the period from May 3 to May 8, 1962.

This report was prepared by C. L. Berthold of the Wind Tunnel Projects Group, Los Angeles Division of North American Aviation, Inc.

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ABSTRACT

This report presents dynamic stability data from tests of command module entry and launch escape configurations of a 0.055-scale Apollo model (FD-2) in the Langley 8 Foot Transonic Pressure Tunnel. Tests were conducted from 0.30 to 1.20 Mach number and at angles of attack near proposed flight attitudes.

The dynamic stability parameters are presented as standard NASA coefficients in both tabular and plotted form for all configurations tested. In addition, tunnel operating conditions, configuration description, computation equations, and tabular data identifying key are included.

This report presents basic wind tunnel test data only, in order to make the test results available at the earliest possible date. Analyses and summary of results will be reported later under separate cover.



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I. INTRODUCTION

Dynamic stability tests were conducted on 0.055-scale Apollo (FD-2) models in the Langley 8 Foot Transonic Pressure Tunnel from May 3, 1962 to May 8, 1962. Dynamic stability parameters were obtained for command module entry and launch escape configurations with oscillation in pitch; and for the entry configuration only, with oscillation in yaw.

Tests were conducted at 0.30, 0.70, 0.90, 1.00 and 1.20 Mach number for the basic configurations at high Reynolds number. Runs were also made to investigate the effects of Reynolds number, oscillation center location and a simulated balance cover at 0.70, 1.00, and 1.20 Mach number. Reynolds numbers, based on the maximum model diameter, varied from 0.61×10^6 to 3.49×10^6 . All dynamic stability derivatives were measured during forced oscillation of the model in pitch or yaw over an amplitude of approximately $\pm 2^\circ$ about the oscillation center.



II. REMARKS

This test was performed to investigate the dynamic stability characteristics of the 0.055-scale Apollo (FD-2) models in the subsonic and transonic speed ranges using models, equipment, and methods of obtaining data similar to that described for a previous test (Reference a) which covered the range from 2.40 to 4.65 Mach number.

Several techniques are currently available for measuring dynamic stability derivatives of models in wind tunnels. This test was performed utilizing what has been termed the inexorable method in which the model is mechanically forced to oscillate in a single degree of freedom at known angular frequency and amplitude while measurements are made of the moment required to sustain the motion.

The support and attached model were forced to perform a constant-amplitude, essentially sinusoidal motion about the oscillation axis by a mechanical scotch yoke and crank arrangement. The crank was connected by a driveshaft to an electric motor mounted in the downstream end of the sting and the drive motor speed was set at various constant values to provide a range of oscillating frequencies. (For maximum accuracy, most test points were recorded at or near the natural frequency of the oscillating model system).

Springs of different stiffness were available to cover a range of resonant frequencies within the range of operating frequencies. These springs were equipped with calibrated strain gages to provide a signal proportional to the displacement.

A stiff strain gage beam, located between the model mounting point and the pivot axis, gave a signal proportional to the moment applied to oscillate the model. It was located so as to be uninfluenced by any friction or mechanical play in the system.

The model was rigidly forced to oscillate with an amplitude of approximately $\pm 2^\circ$ at known angular frequency and the pivot axis could be rotated 90° ; therefore, tests could be made with the model oscillating in pitch or yaw.



II. REMARKS - continued

By resolving the moment and amplitude functions into orthogonal components the resultant applied moment and displacement and the phase angle between them may be found. With the known oscillation frequency, the aerodynamic-damping and oscillatory-stability moments can be computed.

The tabular and plotted data are presented in Appendices A and B in NASA standard coefficient form referred to the body system of axes originating at the oscillating center. Dynamic stability parameters are utilized to indicate aerodynamic damping-in-pitch ($C_{mq} + C_{m\alpha}$), oscillatory longitudinal stability ($C_{m\alpha} - k^2 C_{mq}$), and the reduced frequency parameter ($\frac{\omega l}{V}$) for tests with

oscillations in pitch for the entry, launch escape (2 configurations), and command module exit configurations. In addition, coefficients are given for aerodynamic damping-in-yaw ($C_{nr} - C_{ng} \cos \alpha$), oscillatory directional stability ($C_{ng} \cos \alpha + k^2 C_{nr}$) and the reduced frequency parameter ($\frac{\omega l}{V}$) for the entry configuration only with

oscillations in yaw. The plotted data presents these parameters as a function of angle of attack.

The basic configurations were tested at Mach numbers of 0.30, 0.70, 0.90, 1.00 and 1.20 at the highest Reynolds number obtainable for angles of attack near the proposed flight attitudes. The runs made to obtain the effect of Reynolds number, oscillation center location, and simulated balance cover included only tests at 0.70, 1.00, and 1.20 Mach number. The nominal angle of attack ranges were: Command Module (entry) 136° to 154° , Command Module (exit) -12° to $+6^\circ$, Launch Escape Configuration -6° to $+6^\circ$. The majority of data was recorded at nominal 2° increments of set angle of attack throughout these ranges while the model was being rigidly forced to oscillate $\pm 2^\circ$ in pitch about the set angle. In addition the model was forced to oscillate in yaw ($\pm 2^\circ$) during one Mach number series for the entry configuration (Run 7). Smaller increments of set angle of attack were used in areas where large changes in stability parameters were observed.

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II. REMARKS - continued

Physical limitations imposed by the size of the model and existing dynamic balance have made it impossible to locate the oscillation center ideally on the design center of gravity. Therefore, an investigation was conducted on the command module (entry attitude) to determine the magnitude of error introduced by such displacement. In addition to the tests on the basic entry model configurations with no spacer (Runs 1, 2, and 7), these runs were made with 1.75 inch and 1.00 inch spacers (Runs 6 and 8 respectively) between the end of the balance and the model attach point to further displace the oscillation center from its design c.g. location.

Since the oscillation center of the balance for the launch escape configuration was also displaced from the design c.g., due to space limitations, brief tests were conducted to investigate the effect of a simulated balance housing protruding through the apex of the command module into the area defined by the legs of the escape tower (Run 5). This was accomplished by removing the apex section of the command module and replacing it with a 2.50 in. diameter by 1.37 in. long cylinder simulating a balance cover. This investigation was conducted to determine if future launch escape models could be tested with the balance relocated, placing the oscillation center on the c.g., without adverse aerodynamic effects.

The command module alone in the exit configuration (heat shield aft) was run with a 1.21 in. spacer placed between the end of the balance and the model attach point to place the oscillation center on the design c.g. of the module.

Due to adverse model location and malfunction of equipment the schlieren photographs were not considered of sufficient quality to be transmitted by the testing facility.



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III. MODEL DESCRIPTION

A. General and Model Drawings

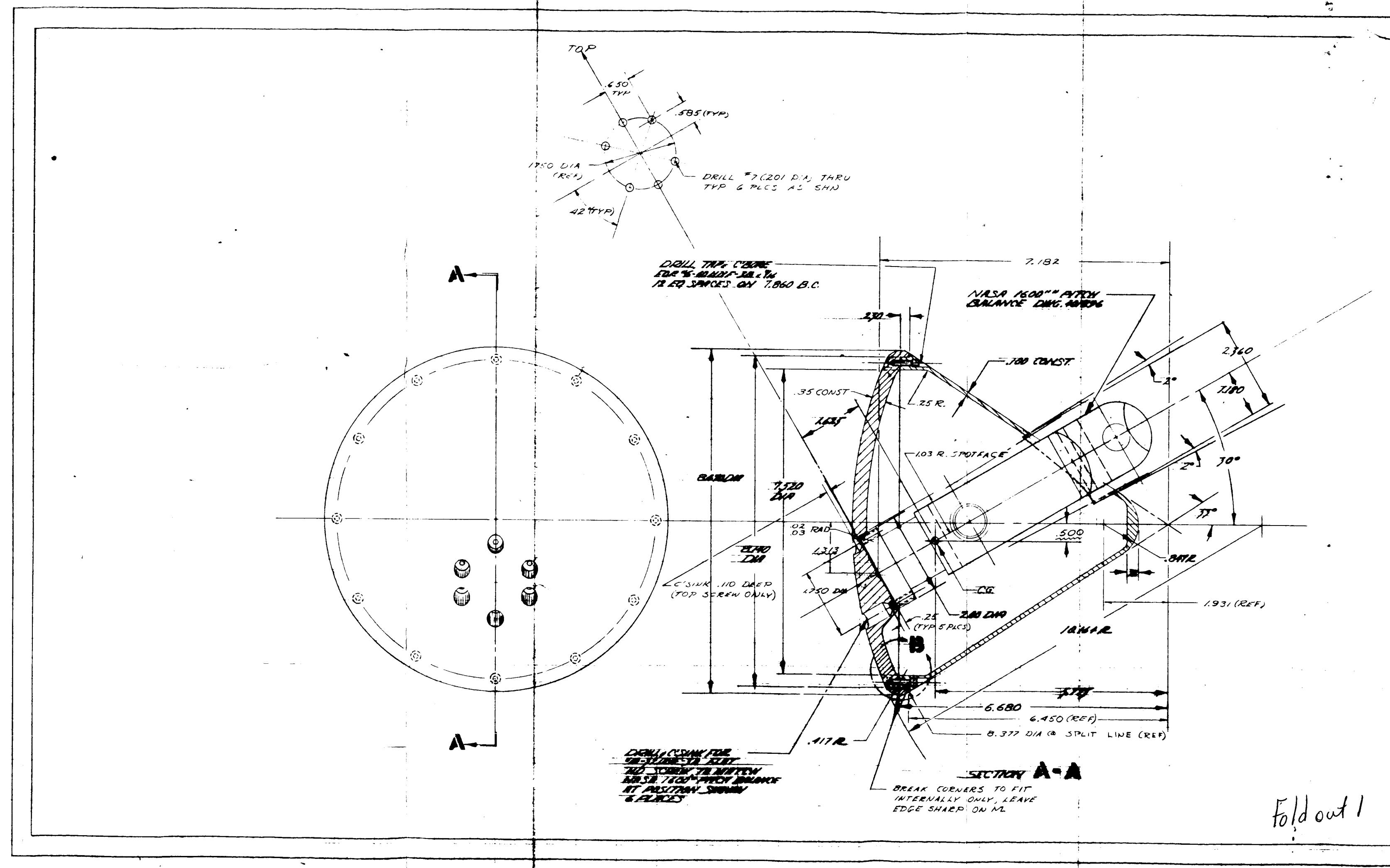
The FD-2 Dynamic Stability Model tested in the Langley 8 Foot Transonic Pressure Tunnel from May 3, 1962 to May 8, 1962 was a 0.055-scale representation of the current Apollo command module and launch escape system configurations.

The configurations tested were aerodynamically smooth for all test conditions. Lightweight materials were utilized in construction of the model, to reduce moment-of-inertia effects, whenever consistent with the structural integrity as established in Reference (b). The command modules were constructed of aluminum alloy (7075-T6), escape tower of Armco steel (17-4PH SST) and escape rocket of magnesium (QQ-M-31).

Except for the runs investigating the effect of oscillation center location (Runs 6 and 8), the oscillation axis was located as close as possible to the center of gravity of the represented full scale Apollo configuration within the physical limits imposed by the model size and the balance dimensions.

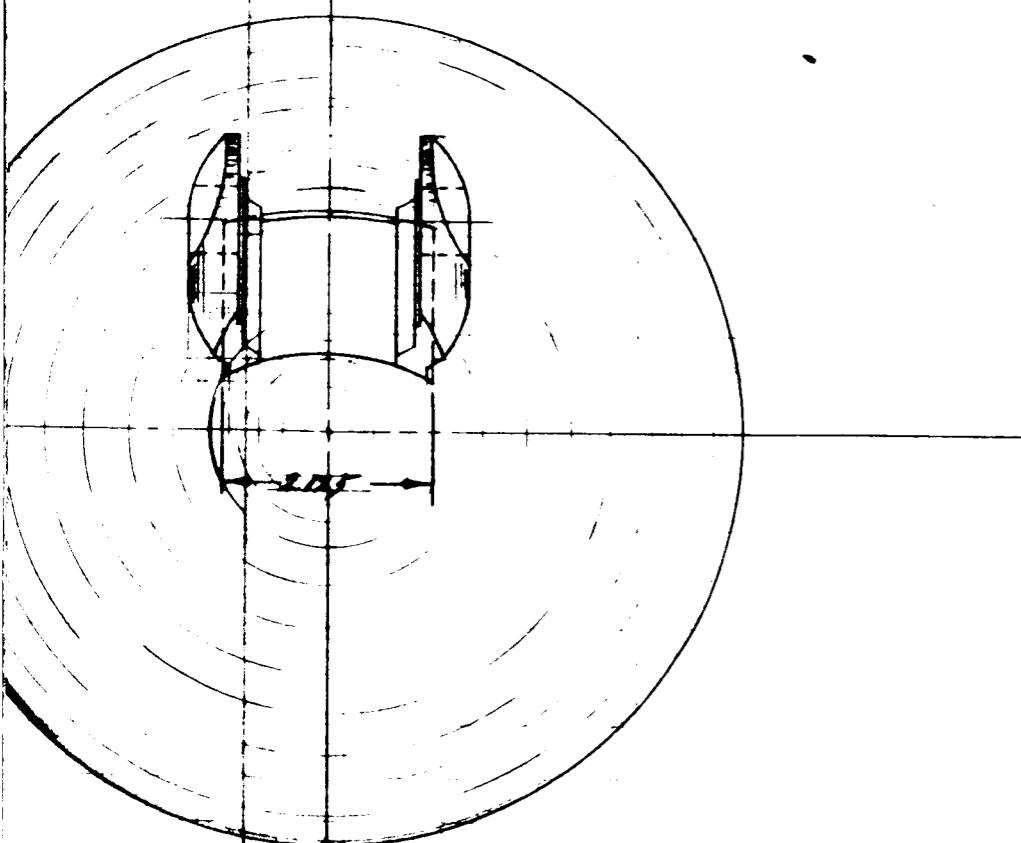
The models were sting mounted with the balance contained within the model to minimize support interference. To allow pitching through angles of attack near the proposed flight attitudes, the models were constructed so that the command module axis of symmetry and balance center line formed an angle of 30° for the entry configuration and 8° for the launch escape vehicle.

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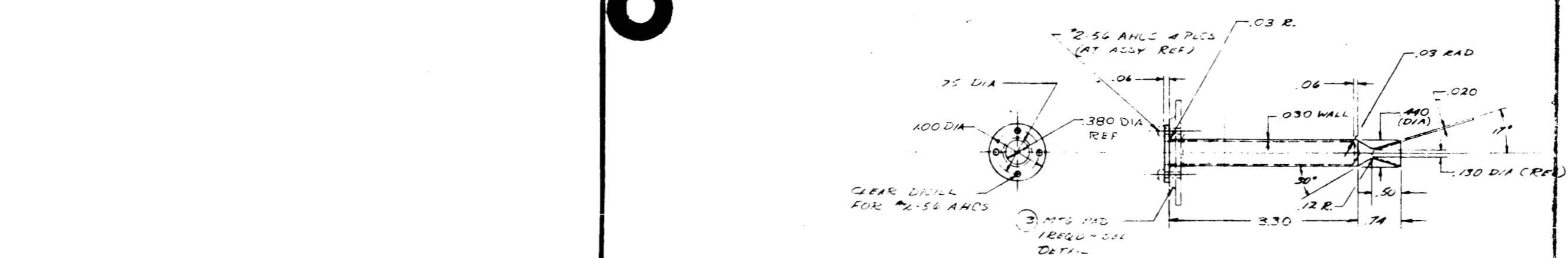
2. MATE TO DT-78 ALUM
1. MODEL PART NO. = 011
NOTES UNLESS OTHERWISE SPECIFIED

REL N^o 2
DATE 2-13-62
JOB N^o 242-518

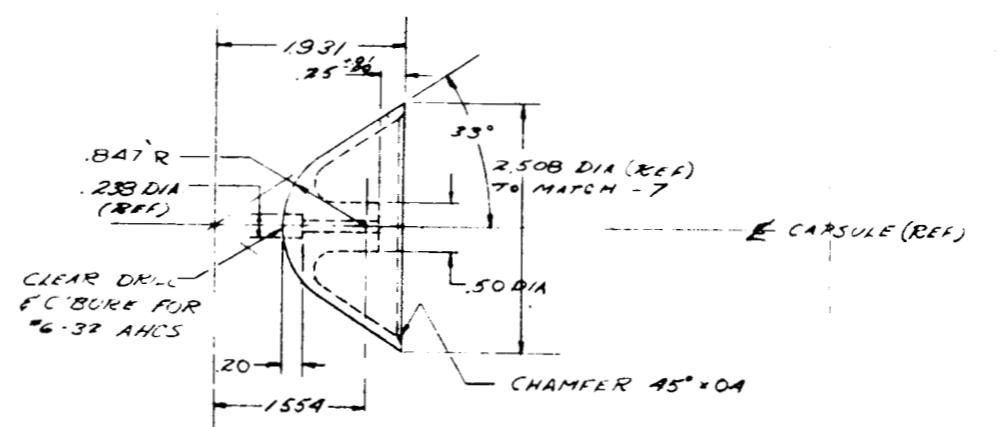
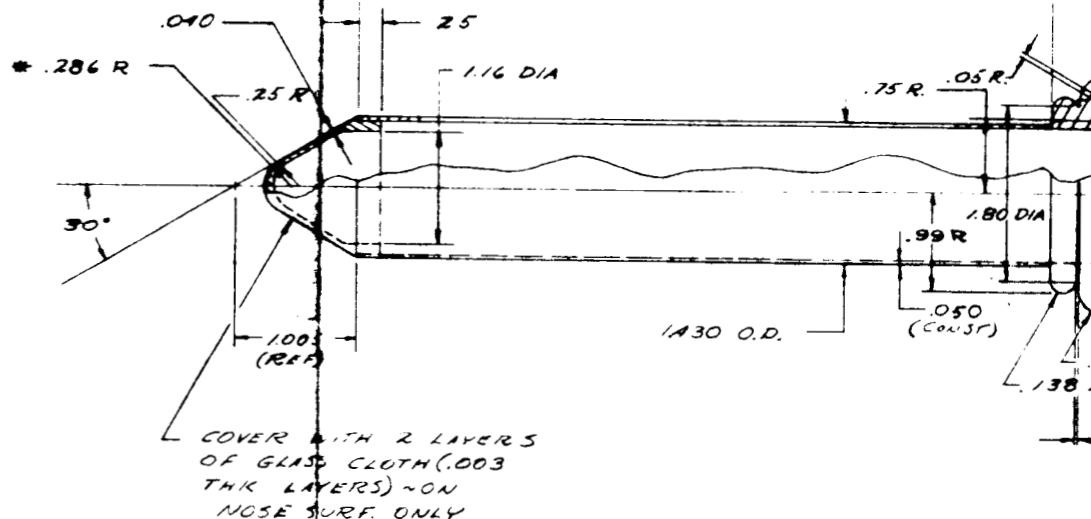
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REL N^o 2 REVISED BASE ATTACHMENT FADDED DIMEN DR-2-1065 2-13-62

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.040	TO .150-.002-.001	±1/16	ANGLE NOMINAL 30° ±1.00	JX = ±1.00	DRYAR				MODEL ASSY-APOLLO
.125	TO .300-.004-.001		SURFACE ROUGHNESS	DRYAR					FD-2 REENTRY CONVE
.234	TO .450-.004-.001		✓ PER MIL-STD-19	DRYAR					(CLANGLEY LIPPLITT)
.93/64	TO .1/2-.004-.001		HEAT	DRYAR					
.49/64	TO .1/2-.007-.001		HEAT	DRYAR					
1-1/64 TO	.5+.010-.001		FINISH	DRYAR					
SCALE FULL WT									
DIA	SIZE	721-01059							

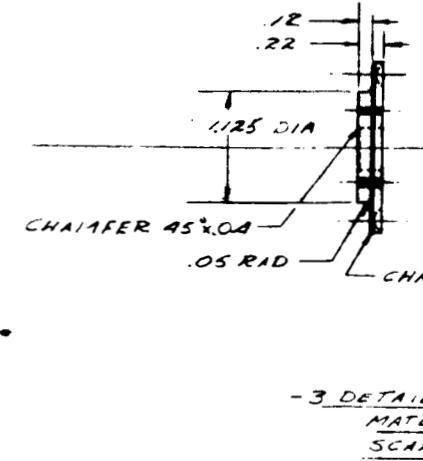
NORTH AMERICAN AVIATION, INC.
DESIGN AND MANUFACTURE DIVISION
100 NORTH LANDISWOOD BLVD., SANTA MONICA,
CALIFORNIA



-9 DETAIL ~ JETISON ROCKET (IREQD)
 MATL ~ 7075-T6 AL ALY
 SCALE ~ ACTUAL SIZE

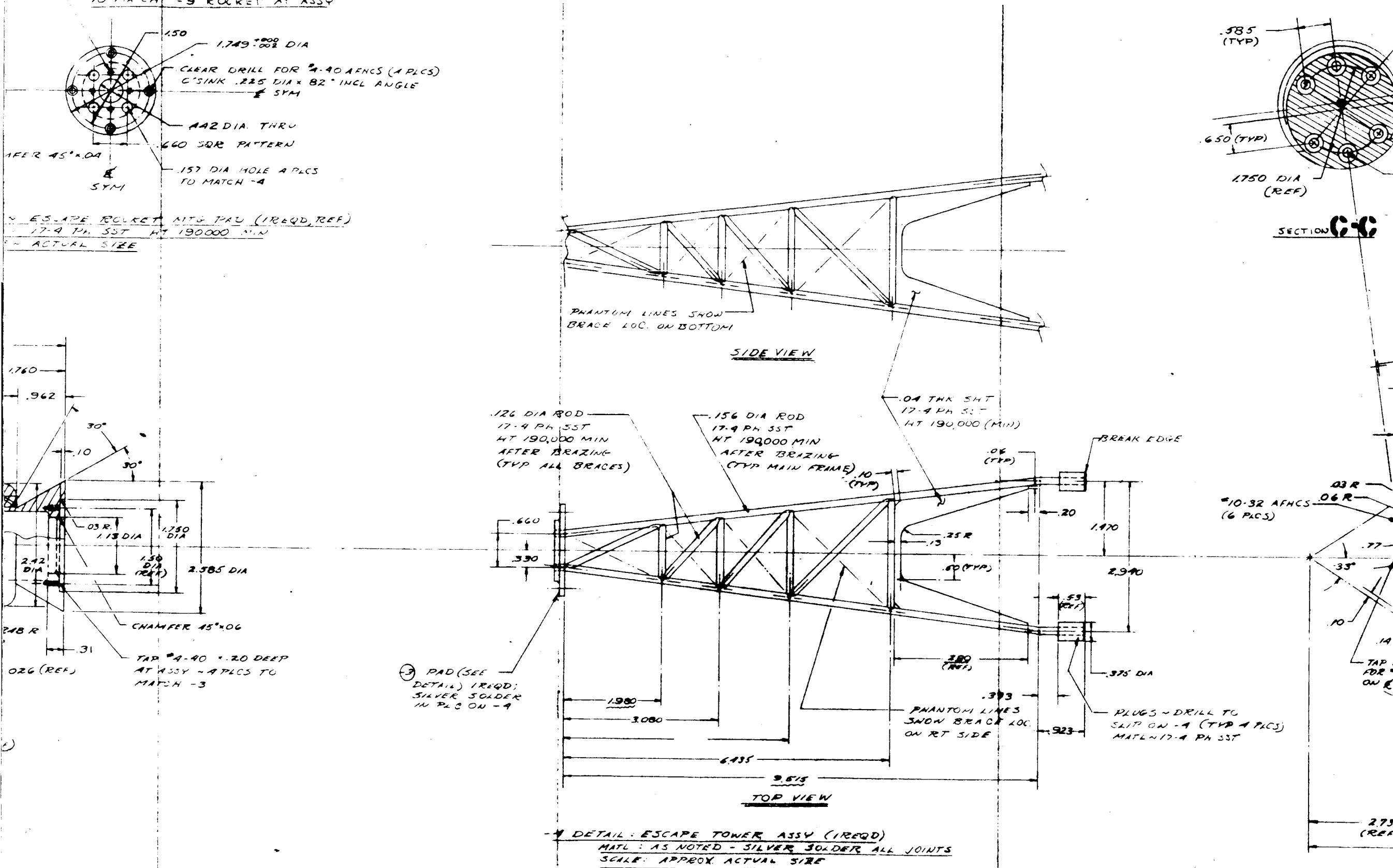


-8 DETAIL ~ CAPSULE NOSE (IREQD. REF)
 MATL ~ 7075-T6 AL ALY
 SCALE ~ ACTUAL SIZE



-5 DETAIL - ESCAPE ROCKET ASSY (IREQD. REF)
 MATL : MAGNESIUM QQ-M-31 (AZ61A-F)
 SCALE : ACTUAL SIZE

Foldout 1



Foldout 2

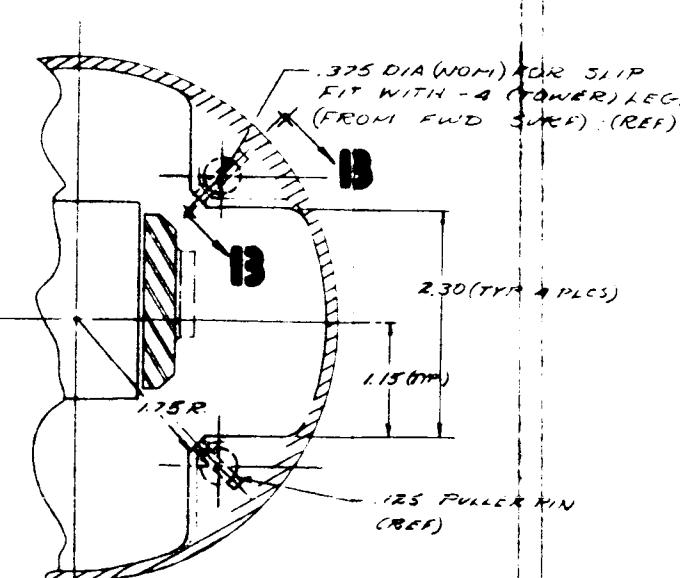
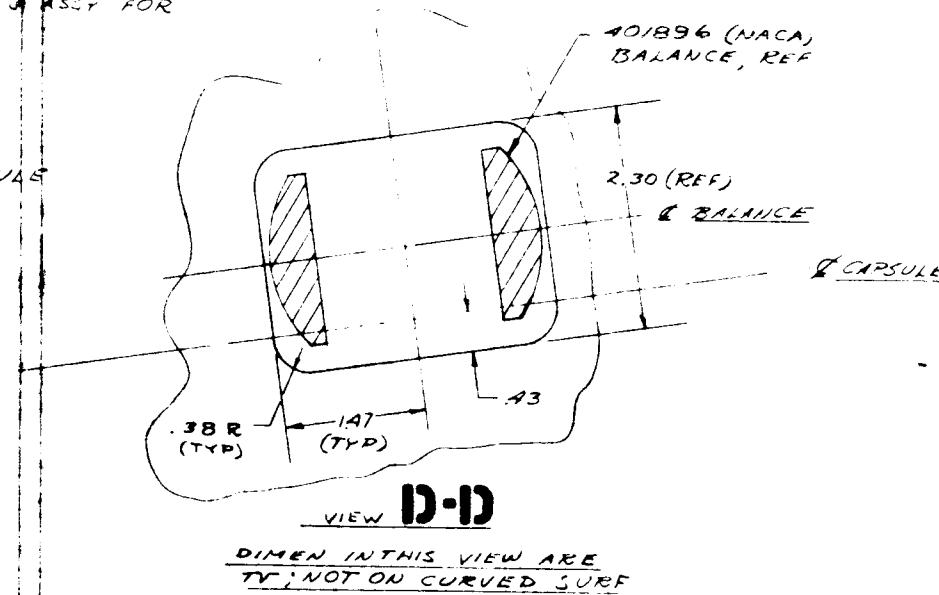
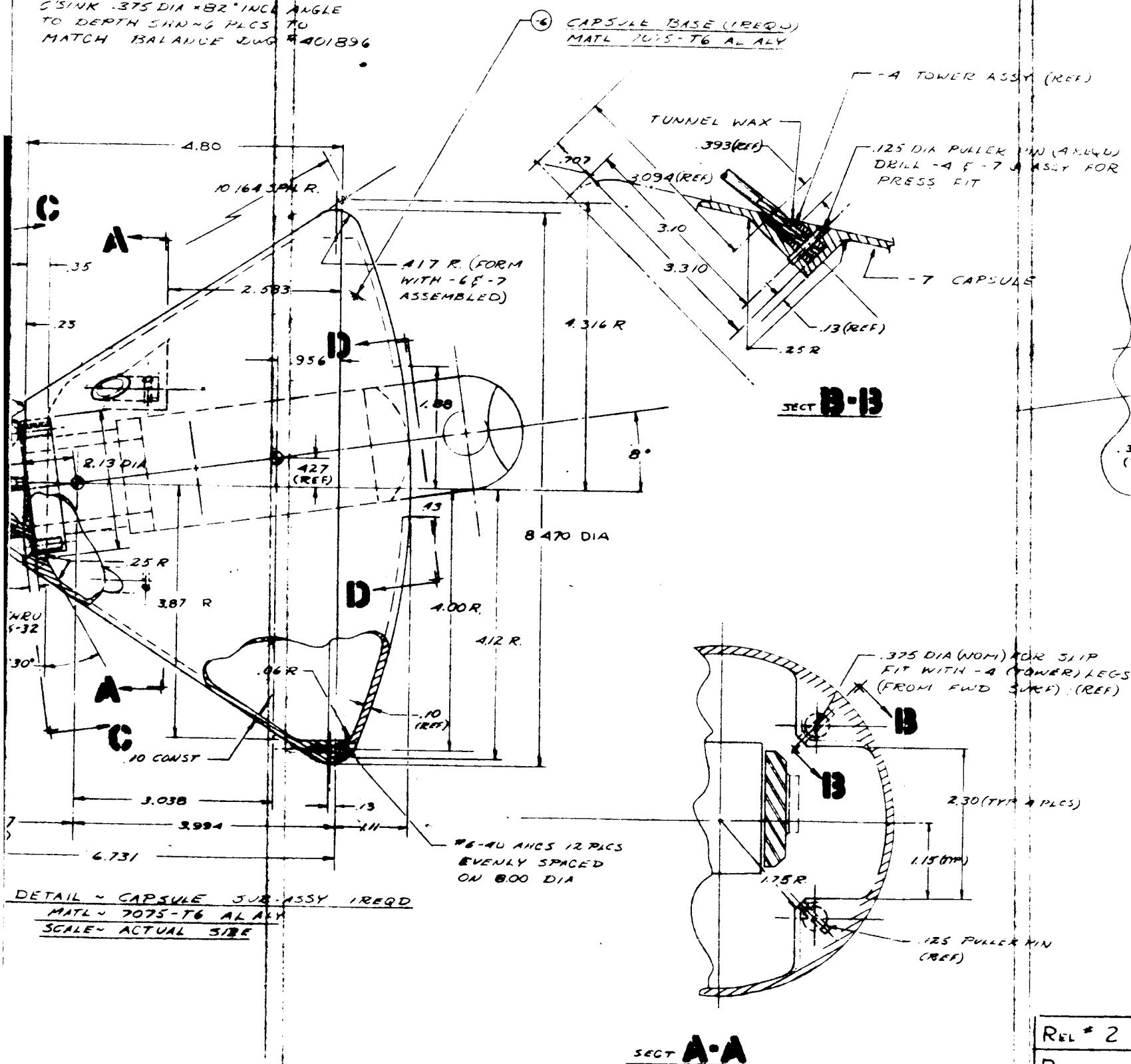
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PAGE 7

- CLEAR DRILL FOR #10-3R
S'SINK .375 DIA X B2" INCH ANGLE
TO DEPTH SHNNG PLCS TO
MATCH BALANCE JUG #40189



DETAIL ~ CAPSULE SUB-ASSY IREQ
MATL ~ 7075-T6 AL ALY
SCALE ~ ACTUAL SIZE

Rev 3	ADDED -8 (NOSE)	SB Revision 2-14-62
REV 2	REDRAWN & REVISED	2-14-62
DATE	1 FEB 62	
BY	T.G. ALEXER	
CHE BY		MODEL ASSY - APPROX
APPD BY		FD-2, LAUNCH
APPD BY		ESCAPE CONFIG
APPD BY		(LANGLEY UPWT)
Model Factor .055		NORTH AMERICAN AVIATION, INC. GRUMMAN INSTRUMENT DIVISION 10014 LAKWOOD BLVD., DOWNEY, CALIFORNIA
SCALE ALL 6 INCHES		DIMG SIZE B
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III. MODEL DESCRIPTION - continued

B. Nomenclature & Dimensions

	<u>Dimensions</u> <u>Full Scale</u>
<u>E4</u> Escape Rocket Motor (Dwg. 7121-01058-5)	
Total Length (including jettison motor)	248.40 in.
Diameter of Escape Rocket	26.00 in.
Diameter of Escape Rocket Base	47.00 in.
Skirt Flare Angle	30.00°
Nose Radius	5.20°
Jettison Motor -located aft of rocket motor	
Length of Jettison Motor	69.50 in.
Diameter of Jettison Motor	8.00 in.
Jettison Motor-nozzle exit half angle	17.00°

E Same as "E4" except with toroid tanks (not tested)

T12, Escape Tower Structure (Dwg. 7121-01058-4)

Total Length	175.00 in.
Number of Longitudinal Members	4
Diameter of Longitudinal Members	2.84 in.
Diameter of Cross Braces	2.29 in.
Distance Between Attachment Points	53.45 in.

C, Command Module (Dwg. 7121-01059)

Maximum Diameter	154.00 in.
Radius of Spherical Blunt End	184.80 in.
Corner Radius	7.58 in.
Nose Cone Semi-angle	33.00°
Nose Cone Vertex Radius	15.40 in.



IV. TEST PROCEDURE

A. Test Nomenclature

A maximum cross-sectional area, sq. ft., $\frac{\pi \ell^2}{4}$

ℓ maximum body diameter, ft.

q_∞ free stream dynamic pressure, lb/sq. ft.

α angle of attack of model center line, deg. or radians

$\dot{\alpha}$ rate of change of angle of attack, radians/sec.

V free stream velocity, ft/sec.

ω angular frequency of oscillation, radians/sec.

k reduced frequency parameter, $\frac{\omega \ell}{V}$

R Reynolds number based on ℓ

q angular velocity in pitch, radians/sec.

\dot{q} rate of change of pitching angular velocity, radians/sec.

r angular velocity in yaw, radians/sec.

\dot{r} rate of change of yawing angular velocity, radians/sec.

β angle of sideslip of model center line, radians

$\dot{\beta}$ rate of change of angle of sideslip, radians/sec.

C_m pitching-moment coefficient, $\frac{\text{Pitching Moment}}{q_\infty A \ell}$

C_n yawing-moment coefficient, $\frac{\text{Yawing Moment}}{q_\infty A \ell}$

I moment of inertia, slug-ft²

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IV. TEST PROCEDURE - continued

A. Test Nomenclature - continued

The data presented are referred to the body system of axes and all moments are referred to the intersection of the oscillation axes. Additional coefficients and symbols used in the equations for data reduction are defined as follows:

C — system damping moment, in-lb/radian

K — system spring constant, in-lb/radian

$C_{aero} = C_{run} - C_{tare}$, where $C_{tare} = \text{constant}$

$$(K-I\omega^2)_{aero} = (K-I\omega^2)_{run} - (K-I\omega^2)_{tare}$$

For data of type 2 (oscillation in pitch, wingless bodies)

$$C_{mq} + C_m \dot{\alpha} = - \frac{VC_{aero}}{12 q_\infty A \ell^2}$$

$$\ell = 0.7058 \text{ ft.}$$

$$C_m \ddot{\alpha} - k^2 C_{mq} = - \frac{(K-I\omega^2)_{aero}}{12 q_\infty A \ell}$$

$$A = 0.3912 \text{ ft.}^2$$

$$k = \frac{\omega \ell}{V}$$

For data of type 4 (oscillation in yaw, wingless bodies)

$$C_{nr} - C_n \dot{\beta} \cos \alpha = - \frac{VC_{aero}}{12 q_\infty A \ell^2}$$

$$C_n \ddot{\beta} \cos \alpha + k^2 C_{nr} = + \frac{(K-I\omega^2)_{aero}}{12 q_\infty A \ell}$$

$$k = \frac{\omega \ell}{V}$$

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IV. TEST PROCEDURE - continued

A. Test Nomenclature - continued

$$q_{\infty} = 0.7 \text{ pM}^2$$

$$p = \frac{\text{Stagnation pressure}}{(1 + .2M^2)3.5}$$

$$V = \frac{(49.0236) \sqrt{T_t}}{(1 + .2M^2)^{1/2}} M$$

(where T_t is tunnel total temperature in $^{\circ}\text{R}$)

$$\text{Reynolds number} = 2l q_{\infty} / \mu V \quad (\text{where } \mu = \text{viscosity, } \frac{\text{lb-sec.}}{\text{ft}^2})$$



IV. TEST PROCEDURE - continued

B. Model Installation

The FD-2 model was installed on the NASA 1600 in-lb. dynamic pitch balance (Dwg. 401896) which was mounted on a straight sting containing the oscillating mechanism. The drive motor, clutch resolvers, and frequency generator were all contained in the downstream end of the sting which was stiffened to provide a resonant frequency above the maximum oscillating frequency of the model. The oscillating mechanism was designed to provide maximum stiffness of all drive linkages so that the model responded only to the essentially sinusoidal forcing input of the crank and Scotch yoke.

The models were mounted so that the sting center line and command module axis of symmetry formed an angle of 30° for the entry configuration and 8° for the launch escape configuration to allow testing through angles of attack of 136° to 154° and -12° to +6°, respectively. The 8 Ft. Transonic Pressure Tunnel dynamic balance sting support was attached to a tapered vertical strut which in turn is connected to a motor driven metal arc. The system is so designed as to keep the model on the tunnel center line throughout the angle of attack range. In addition, the sting was rigidly braced to the tunnel walls by preloaded stay cables to restrict any sting motion that might be present.



IV. TEST PROCEDURE - continued

C. Instrumentation

The NASA 1600 in.-lb. dynamic pitch balance was used to measure the moment and displacement functions as the model was mechanically forced to oscillate in a single degree of freedom.

In operation of the system, calibrated outputs of the moment and displacement strain gages are passed through coupled electrical sine-cosine resolvers which rotate at the frequency of oscillation. The resolvers transformed the outputs into orthogonal components from which the resultant applied moment and displacement and the phase angle between them were found. With the known oscillation frequency, the aerodynamic-damping and oscillating stability moments were then computed.

All data were computed on a remotely located IBM 7090 computer.

D. Data Reduction Constants

All data were reduced and presented in standard NASA coefficient form referred to the body system of axes originating at the oscillation center.

$$\text{Reference area} = A = 0.3912 \text{ ft.}^2$$

$$\text{Reference length} = \ell = 0.7058 \text{ ft. (Diam.)}$$



V. REFERENCES

- (a) SID-62-536, "Data Report for Langley Unitary Plan Wind Tunnel Tests (Project 349) of Apollo Model (FD-2) NAS 9-150", 28 May 1962.
- (b) SID-62-103, "Structural Analysis of the .055-scale Apollo Wind Tunnel Models", 16 February 1962.
- (c) NACA RM L58A28 "Dynamic Directional Stability Derivatives for a 45° Swept-Wing-Vertical-Tail Airplane Model at Transonic Speeds and Angles of Attack, with a Description of the Mechanism and Instrumentation Employed" by Albert L. Braslow, Harleth G. Wiley and Cullen Q. Lee, April 21, 1958.
- (d) NASA TM X-39 "Dynamic-Longitudinal and Directional Stability Derivatives for a 45° Sweptback-Wing Airplane Model at Transonic Speeds" by Ralph P. Bielat and Harleth G. Wiley, August 1959.
- (e) NASA TM X-285 "Wind Tunnel Investigation at Low Subsonic Speeds of the Static and Oscillatory Stability Characteristics of Models of Several Space Capsule Configurations" by Joseph L. Johnson, Jr., May 1960.

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APPENDIX "A"

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Appendix "A"



A. TABULATED DATA FORMAT

<u>Column Heading</u>	<u>Item</u>	<u>Definition or Remarks</u>
PRJ	Project No.	From project No. 233 of 8' TPT
RUN	Run No.	Each Mach number series for a configuration is assigned a run number.
POINT	Point No.	Sequence in which data were taken.
CONF	Configuration No.	10. Command Module, (C) entry, no spacer 11. Command Module, (C) entry, 1" spacer 12. Command Module, (C) entry, 1.75" spacer 2. Launch Escape Config. (E4T12C) 20. Launch Escape Config., balance cover on apex 3. Command Module, (C) exit, 1.21" spacer
T	Type of Data	2. Wingless body in pitch 4. Wingless body in yaw
B	Batch No.	Not applicable for this data
Q	Dynamic Pressure	Free-stream dynamic pressure lb/ft ²
V	Velocity	Free-stream velocity ft/sec
RN	Reynolds No.	Reynolds No. x 10 ⁻⁶ based on a reference length of 0.7058 ft. (This is the maximum diameter of the command module model)



A. TABULATED DATA FORMAT - continued

<u>Column Heading</u>	<u>Item</u>	<u>Definition or Remarks</u>
TP	--	Corrected phase angle between driving torque and model displacement. Values near 90° and 270° indicate velocity resonance.
MACH	Mach No.	Free-stream Mach number
AOS	Angle of Sideslip	Mean angle of sideslip, degrees
AOA	Angle of Attack	Angle of attack of the model, degrees
FREQ	Frequency	Frequency of the forced oscillation, cycles/sec.
K	Reduced Frequency Parameter	k, see equations
CMQ	$C_{m_q} + C_{m\dot{\alpha}}$	Damping-in-pitch parameter
CMA	$C_{m\dot{\alpha}} - k^2 C_{m_q}$	Oscillatory directional stability parameter
CNR	$C_{n_r} - C_{n\dot{\beta}} \cos \alpha$	Damping-in-yaw parameter
CNB	$C_{n\dot{\beta}} \cos \alpha + k^2 C_{n_r}$	Oscillatory directional stability parameter

Note: See Test Nomenclature for definition of stability parameters.



B. RUN INDEX

<u>Run No.</u>	<u>Configuration</u>	<u>Mach No.</u>	<u>Angle Range</u>	<u>RNx10⁻⁶</u>	<u>q_∞ PSF</u>
1	C-Entry (Command Module)	1.20	154° to 136°	2.96	879
		1.00		2.88	782
		.90		2.78	709
		.70		3.49	742
		.30		2.50	251
2	C-Entry (Command Module)	1.20	154° to 136°	.75	223
		1.00		.72	198
		.70		.62	132
3	E4T12C (Launch Escape Vehicle)	1.20	-6° to +5°	2.96	878
		1.00	-5° to +3°	2.88	781
		.90	-5° to +4°	2.78	708
		.70	-4° to +3°	3.49	742
		.30	-8° to 0°	2.50	251
4	E4T12C (Launch Escape Vehicle)	.70	-12° to +6°	.62	133
		1.00		.72	197
		1.20		.75	221
5	E4T12C (Launch Escape Vehicle) {balance cover on apex}	1.20	-6 to +6°	2.96	875
		1.00	-6 to +4°	2.88	779
		.70	-3 to +2°	3.49	744
6	C-Entry (Command Module) (1.75" spacer)	1.20	154° to 143°	2.96	877
		1.00	154° to 138°	2.88	780
		.70	154° to 142°	3.49	742
		.70	154° to 136°	3.49	741
		.30		2.50	251
7	C-Entry (Command Module)	.90	154° to 136°	2.78	708
		.90		2.88	784
		1.00		2.96	881
		1.20			
		.70	154° to 141°	2.96	876
8	C-Entry (Command Module) (1.00" spacer)	1.00	154° to 150°	2.88	778
		.70	154° to 136°	3.49	742
		.70	154° to 141°	2.96	874
9	C-Exit (Command Module) (1.21" spacer)	.90	-12° to +6°	2.78	712
		.70		3.49	743
		.30		2.50	251
		1.20		2.96	874
		1.00		2.88	778

Note: 1. Run 7 oscillated in yaw, all others in pitch.
 2. Reynolds numbers based on maximum model diameter.
 3. All quoted values are nominal.

PRJ	RUN	PCINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA
233	001	0033		10	2	00	878.61	1250.5	2.958 126.51	1.200	.00	150.00	14.70	.0521	.06-	.086-
233	001	0034		10	2	00	878.78	1250.5	2.959 6.72	1.200	.00	154.00	14.65	.0519	.01-	.089-
233	001	0035		10	2	00	878.94	1250.5	2.959 73.90	1.200	.00	152.01	14.70	.0521	.02-	.088-
233	001	0036		10	2	00	878.78	1250.5	2.959 94.03	1.200	.00	149.99	14.71	.0521	.05-	.088-
233	001	0037		10	2	00	878.94	1250.5	2.959 255.03	1.200	.00	148.01	15.27	.0541	.29	.104-
233	001	0038		10	2	00	879.03	1250.5	2.960 265.83	1.200	.00	146.00	15.27	.0541	.39	.107-
233	001	0039		10	2	00	878.90	1250.5	2.959 64.88	1.200	.00	144.00	13.14	.0465	.10-	.039-
233	001	0040		10	2	00	878.86	1250.5	2.959 86.53	1.200	.00	142.00	11.66	.0413	.37-	.004
233	001	0041		10	2	00	878.98	1250.5	2.960 93.00	1.200	.00	140.00	9.49	.0336	.76-	.061
233	001	0042		10	2	00	878.90	1250.5	2.959 88.65	1.200	.00	138.00	7.63	.0270	.85-	.097
233	001	0043		10	2	00	878.90	1250.5	2.959 84.32	1.200	.00	136.00	7.01	.0248	.63-	.106
233	001	0046		10	2	00	781.93	1079.6	2.882 216.33	1.000	.00	153.99	14.64	.0601	.00	.096-
233	001	0047		10	2	00	781.97	1079.6	2.882 238.54	1.000	.00	151.99	14.77	.0606	.01	.101-
233	001	0048		10	2	00	781.78	1079.6	2.881 286.24	1.000	.00	149.99	14.61	.0600	.05	.097-
233	001	0049		10	2	00	781.82	1079.6	2.882 298.53	1.000	.00	147.99	14.54	.0597	.05	.095-
233	001	0050		10	2	00	783.82	1079.6	2.889 246.69	1.000	.00	146.00	15.23	.0625	.12	.116-
233	001	0051		10	2	00	781.89	1079.6	2.882 272.70	1.000	.00	144.00	15.80	.0648	.67	.146-
233	001	0052		10	2	00	782.67	1079.6	2.885 298.71	1.000	.00	142.00	14.07	.0577	.09	.078-
233	001	0053		10	2	00	782.01	1079.6	2.882 279.27	1.000	.00	139.99	13.45	.0552	.11	.054-
233	001	0054		10	2	00	781.78	1079.6	2.881 71.44	1.000	.00	137.99	12.25	.0503	.02-	.012-
233	001	0055		10	2	00	781.89	1079.6	2.882 108.91	1.000	.00	135.99	11.11	.0456	.07-	.024
233	001	0058		10	2	00	709.24	987.4	2.787 295.75	.900	.00	154.00	14.46	.0649	.08	.102-
233	001	0059		10	2	00	710.04	987.4	2.790 265.90	.900	.00	152.00	14.65	.0657	.11	.107-
233	001	0060		10	2	00	709.04	987.4	2.786 291.79	.900	.00	150.00	14.59	.0655	.20	.110-
233	001	0061		10	2	00	708.74	987.4	2.785 246.83	.900	.00	148.01	15.69	.0704	.22	.146-
233	001	0062		10	2	00	709.74	987.4	2.789 267.25	.900	.00	146.01	16.34	.0733	.73	.181-
233	001	0063		10	2	00	708.80	987.4	2.785 311.33	.900	.00	144.01	14.92	.0670	.16	.129-
233	001	0064		10	2	00	708.97	987.4	2.786 21.77	.900	.00	142.00	14.00	.0628	.04-	.087-
233	001	0065		10	2	00	709.64	987.4	2.788 242.29	.900	.00	140.01	13.03	.0585	.05	.040-
233	001	0066		10	2	00	708.77	987.4	2.785 58.08	.900	.00	136.01	10.72	.0481	.12-	.034
233	001	0069		10	2	00	742.72	790.0	3.490 284.72	.700	.00	154.01	15.60	.0875	.17	.147-
233	001	0070		10	2	00	743.39	790.0	3.493 276.46	.700	.00	152.01	15.37	.0862	.11	.134-
233	001	0071		10	2	00	743.81	790.0	3.495 300.66	.700	.00	150.00	16.17	.0907	.15	.176-
233	001	0072		10	2	00	742.27	790.0	3.488 262.63	.700	.00	148.00	18.21	.1022	.60	.258-
233	001	0073		10	2	00	742.05	790.0	3.487 266.32	.700	.00	146.00	17.08	.0958	.48	.207-
233	001	0074		10	2	00	742.35	790.0	3.488 267.83	.700	.00	144.00	15.50	.0870	.22	.137-
233	001	0075		10	2	00	742.08	790.0	3.487 289.62	.700	.00	140.00	12.07	.0677	.13	.009-
233	001	0076		10	2	00	742.35	790.0	3.488 34.65	.700	.00	136.00	8.00	.0449	.08-	.102
233	001	0080		10	2	00	250.70	351.6	2.498 273.87	.300	.00	154.00	13.98	.1763	.66	.233-
233	001	0081		10	2	00	250.95	351.6	2.500 280.83	.300	.00	152.01	13.07	.1648	.49	.139-
233	001	0082		10	2	00	250.93	351.6	2.500 265.72	.300	.00	150.00	12.59	.1587	.18	.070-
233	001	0083		10	2	00	250.88	351.6	2.500 270.74	.300	.00	148.01	12.31	.1552	.14	.044-
233	001	0084		10	2	00	251.17	351.6	2.502 171.83	.300	.00	146.00	12.01	.1514	.01-	.002-
233	001	0085		10	2	00	251.12	351.6	2.502 337.62	.300	.00	144.01	11.55	.1456	.01	.023
233	001	0086		10	2	00	251.11	351.6	2.502 299.07	.300	.00	142.00	11.37	.1433	.05	.043

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PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA	
233	001	0087		10	2	00	251.06	351.6	2.501	51.08	.300	.00	140.00	11.07	.1396	.03-	.072
233	001	0088		10	2	00	251.14	351.6	2.502	121.74	.300	.00	136.01	10.74	.1354	.04-	.108

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PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP
233	002	0024	10	2	00	221.97	1250.5	.747	214.87
233	002	0025	10	2	00	225.00	1250.5	.757	135.59
233	002	0026	10	2	00	222.26	1250.5	.748	283.24
233	002	0027	10	2	00	224.71	1250.5	.756	.04
233	002	0028	10	2	00	222.96	1250.5	.750	272.60
233	002	0029	10	2	00	224.13	1250.5	.754	94.19
233	002	0030	10	2	00	222.26	1250.5	.748	83.50
233	002	0031	10	2	00	224.46	1250.5	.755	90.38
233	002	0032	10	2	00	221.51	1250.5	.745	87.40
233	002	0035	10	2	00	197.32	1079.6	.727	62.94
233	002	0036	10	2	00	196.91	1079.6	.725	129.02
233	002	0037	10	2	00	198.02	1079.6	.730	182.94
233	002	0038	10	2	00	199.20	1079.6	.734	274.74
233	002	0039	10	2	00	197.73	1079.6	.728	269.89
233	002	0040	10	2	00	198.13	1079.6	.730	269.89
233	002	0041	10	2	00	196.47	1079.6	.724	251.17
233	002	0042	10	2	00	196.88	1079.6	.725	61.26
233	002	0045	10	2	00	132.41	790.0	.622	288.06
233	002	0046	10	2	00	132.24	790.0	.621	271.70
233	002	0047	10	2	00	132.88	790.0	.624	270.04
233	002	0048	10	2	00	132.51	790.0	.622	270.04
233	002	0049	10	2	00	132.07	790.0	.620	279.28
233	002	0050	10	2	00	131.40	790.0	.617	272.76
233	002	0051	10	2	00	131.05	790.0	.615	278.18

MACH	AOS	AOA	FREQ	K	CNQ	CMA
1.200	.00	154.01	12.92	.0458	.11	.112-
1.200	.00	152.01	12.68	.0449	.04-	.090-
1.200	.00	150.02	12.70	.0450	.22	.097-
1.200	.00	148.01	12.75	.0452	.02-	.101-
1.200	.00	146.01	12.84	.0455	.32	.112-
1.200	.00	144.01	12.51	.0443	.07-	.071-
1.200	.00	142.01	12.14	.0430	.34-	.031-
1.200	.00	140.01	11.83	.0419	.60-	.004
1.200	.00	136.02	10.98	.0389	.72-	.094
1.000	.00	154.00	12.65	.0519	.03-	.100-
1.000	.00	152.01	12.69	.0521	.08-	.103-
1.000	.00	150.00	12.73	.0522	.01-	.103-
1.000	.00	148.01	12.72	.0522	.06	.109-
1.000	.00	146.00	12.83	.0527	.01	.124-
1.000	.00	144.00	12.84	.0527	.00-	.125-
1.000	.00	140.00	12.46	.0511	.01	.075-
1.000	.00	136.00	11.85	.0486	.07-	.001
.700	.00	154.00	12.39	.0695	.08	.101-
.700	.00	152.00	12.37	.0694	.12	.095-
.700	.00	150.00	12.37	.0694	.15	.094-
.700	.00	148.00	12.39	.0695	.14	.098-
.700	.00	144.00	12.38	.0694	.13	.098-
.700	.00	140.01	12.42	.0697	.24	.106-
.700	.00	136.00	11.87	.0666	.16	.001-

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PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA	
233	003	0006	2	2	00	879.61	1250.5	2.962	101.37	1.200	.00	359.99	10.45	.0370	.81-	.263-	NASA
233	003	0007	2	2	00	878.24	1250.5	2.957	101.59	1.200	.00	359.00	10.93	.0387	.38-	.307-	Langley Research Center
233	003	0008	2	2	00	878.24	1250.5	2.957	146.32	1.200	.00	358.00	10.86	.0385	.10-	.299-	Langley Station
233	003	0009	2	2	00	878.86	1250.5	2.959	259.69	1.200	.00	357.00	10.22	.0362	.04	.251-	Hampton, Virginia
233	003	0010	2	2	00	878.19	1250.5	2.957	347.76	1.200	.00	356.00	8.76	.0310	.01	.149-	
233	003	0011	2	2	00	878.19	1250.5	2.957	84.76	1.200	.00	355.00	6.72	.0238	.20-	.023-	
233	003	0012	2	2	00	878.15	1250.5	2.957	103.70	1.200	.00	354.00	3.46	.0122	.74-	.107	
233	003	0013	2	2	00	878.28	1250.5	2.957	95.27	1.200	.00	.00	10.41	.0369	.75-	.264-	CONFIDENTIAL
233	003	0014	2	2	00	878.11	1250.5	2.957	113.97	1.200	.00	1.00	9.91	.0351	1.00-	.212	
233	003	0015	2	2	00	880.65	1250.5	2.965	88.37	1.200	.00	2.00	8.85	.0313	1.15-	.151-	
233	003	0016	2	2	00	878.32	1250.5	2.957	97.88	1.200	.00	3.00	7.64	.0270	1.04-	.069-	
233	003	0017	2	2	00	878.15	1250.5	2.957	62.54	1.200	.00	4.00	5.75	.0203	.71-	.016	
233	003	0018	2	2	00	878.65	1250.5	2.958	147.72	1.200	.00	4.99	3.21	.0113	.42-	.119	
233	003	0021	2	2	00	781.15	1079.6	2.879	230.90	1.000	.00	.00	12.07	.0495	.44	.443-	
233	003	0022	2	2	00	781.27	1079.6	2.880	273.89	1.000	.00	358.99	11.90	.0488	.70	.447-	
233	003	0023	2	2	00	781.27	1079.6	2.880	257.71	1.000	.00	358.00	10.22	.0419	.42	.279-	
233	003	0024	2	2	00	781.27	1079.6	2.880	23.74	1.000	.00	357.00	7.11	.0292	.29-	.067-	
233	003	0025	2	2	00	781.15	1079.6	2.879	55.87	1.000	.00	356.00	4.43	.0181	.93-	.074	
233	003	0026	2	2	00	781.19	1079.6	2.879	137.61	1.000	.00	355.00	2.00	.0082	7.88-	.224	
233	003	0027	2	2	00	781.38	1079.6	2.880	302.28	1.000	.00	.00	11.86	.0487	.38	.452-	
233	003	0028	2	2	00	783.00	1079.6	2.886	50.25	1.000	.00	1.00	10.36	.0425	.21-	.302-	
233	003	0029	2	2	00	782.52	1079.6	2.884	92.38	1.000	.00	2.00	7.37	.0302	1.18-	.063-	
233	003	0030	2	2	00	781.64	1079.6	2.881	85.42	1.000	.00	3.00	2.94	.0120	1.94-	.131	
233	003	0031	2	2	00	781.23	1079.6	2.879	96.92	1.000	.00	2.50	5.19	.0213	1.79-	.058	
233	003	0034	2	2	00	708.20	987.4	2.783	289.16	.900	.00	.00	9.58	.0430	.12	.253-	
233	003	0035	2	2	00	708.27	987.4	2.783	266.12	.900	.00	358.99	9.43	.0423	.10	.237-	
233	003	0037	2	2	00	708.27	987.4	2.783	4.05	.900	.00	357.99	8.04	.0361	.03-	.130-	
233	003	0038	2	2	00	708.43	987.4	2.784	44.74	.900	.00	357.00	6.06	.0272	.43-	.000	
233	003	0039	2	2	00	708.27	987.4	2.783	78.38	.900	.00	356.00	3.86	.0173	.72-	.114	
233	003	0040	2	2	00	708.10	987.4	2.782	150.38	.900	.00	355.00	1.98	.0088	1.43-	.191	
233	003	0041	2	2	00	708.53	987.4	2.784	330.20	.900	.00	.00	9.48	.0425	.18	.257-	
233	003	0042	2	2	00	708.20	987.4	2.783	121.64	.900	.00	1.00	8.65	.0388	.14-	.167-	
233	003	0043	2	2	00	708.74	987.4	2.785	69.12	.900	.00	2.00	6.61	.0296	.63-	.028-	
233	003	0044	2	2	00	708.47	987.4	2.784	166.32	.900	.00	4.00	2.05	.0092	2.42+	.259	
233	003	0048	2	2	00	743.12	790.0	3.492	121.45	.700	.00	.00	7.79	.0437	.21-	.092-	
233	003	0049	2	2	00	740.72	790.0	3.481	62.52	.700	.00	359.01	7.68	.0431	.13+	.093-	
233	003	0050	2	2	00	740.52	790.0	3.480	45.95	.700	.00	358.00	5.89	.0330	.36-	.009	SID-62-1065
233	003	0051	2	2	00	741.71	790.0	3.485	48.74	.700	.00	357.00	3.54	.0198	.76-	.109	
233	003	0052	2	2	00	742.08	790.0	3.487	139.30	.700	.00	356.01	2.02	.0113	1.48-	.180	Appendix "A"
233	003	0053	2	2	00	742.77	790.0	3.490	64.28	.700	.00	359.99	7.77	.0436	.18-	.100-	
233	003	0054	2	2	00	743.83	790.0	3.495	70.52	.700	.00	1.00	6.47	.0363	.54-	.018-	A-8
233	003	0055	2	2	00	741.01	790.0	3.482	111.75	.700	.00	2.00	4.04	.0226	.85-	.112	
233	003	0056	2	2	00	741.21	790.0	3.483	159.64	.700	.00	2.99	1.95	.0109	2.00-	.221	
233	003	0059	2	2	00	251.41	351.6	2.505	110.68	.300	.00	.00	5.27	.0664	.26-	.161	
233	003	0060	2	2	00	251.11	351.6	2.502	93.37	.300	.00	359.00	5.24	.0660	.20-	.160	

PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	
233	003	0061		2	2	00	251.11	351.6	2.502	111.71
233	003	0062		2	2	00	251.12	351.6	2.502	78.23
233	003	0063		2	2	00	251.16	351.6	2.502	62.68
233	003	0064		2	2	00	251.17	351.6	2.502	89.24
233	003	0065		2	2	00	251.19	351.6	2.503	83.81
233	003	0066		2	2	00	251.23	351.6	2.503	274.27

MACH	AOS	AOA	FREQ	K	CMQ	CMA
.300	.00	358.00	5.08	.0640	.28-	.189
.300	.00	357.00	4.87	.0614	.45-	.204
.300	.00	356.00	4.80	.0605	.35-	.209
.300	.00	355.00	5.02	.0633	.47-	.190
.300	.00	354.00	5.19	.0654	.31-	.164
.300	.00	352.00	6.21	.0783	.13	.008

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PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA	
233	004	0001	2	2	00	135.63	790.0	.637	278.96	.700	.00	.00	6.64	.0372	.02-	.117-	NASA
233	004	0002	2	2	00	134.14	790.0	.630	82.30	.700	.00	358.00	6.23	.0349	.40-	.012	Langley Research Center
233	004	0003	2	2	00	134.02	790.0	.629	73.43	.700	.00	356.00	5.70	.0319	.82-	.166	Langley Station
233	004	0004	2	2	00	133.53	790.0	.627	85.62	.700	.00	354.00	5.53	.0310	.79-	.220	Hampton, Virginia
233	004	0005	2	2	00	133.01	790.0	.625	87.74	.700	.00	352.00	5.68	.0318	.79-	.179	
233	004	0006	2	2	00	132.31	790.0	.621	84.05	.700	.00	350.00	5.84	.0327	.51-	.132	
233	004	0007	2	2	00	132.12	790.0	.620	89.92	.700	.00	347.99	5.74	.0322	.65-	.164	CONTINUED
233	004	0008	2	2	00	130.58	790.0	.613	330.45	.700	.00	.00	6.63	.0372	.04-	.120-	
233	004	0010	2	2	00	131.77	790.0	.619	64.54	.700	.00	1.99	6.10	.0342	.71-	.045	
233	004	0011	2	2	00	131.20	790.0	.616	81.81	.700	.00	4.02	5.52	.0309	1.08-	.224	
233	004	0012	2	2	00	132.24	790.0	.621	90.53	.700	.00	6.00	5.43	.0304	1.10-	.252	
233	004	0015	2	2	00	196.84	1079.6	.725	301.80	1.000	.00	.00	7.43	.0305	.27	.277-	
233	004	0016	2	2	00	197.47	1079.6	.727	271.31	1.000	.00	359.00	7.40	.0303	.29	.262-	
233	004	0017	2	2	00	197.65	1079.6	.728	353.62	1.000	.00	358.00	6.98	.0286	.02-	.169-	
233	004	0018	2	2	00	194.69	1079.6	.717	82.47	1.000	.00	356.00	5.88	.0241	.56-	.081	
233	004	0019	2	2	00	195.36	1079.6	.720	68.23	1.000	.00	354.01	5.02	.0206	.88-	.238	
233	004	0020	2	2	00	197.13	1079.6	.726	82.63	1.000	.00	352.01	4.76	.0195	.97-	.283	
233	004	0021	2	2	00	200.65	1079.6	.739	94.86	1.000	.00	350.00	4.93	.0202	.84-	.254	
233	004	0022	2	2	00	198.10	1079.6	.730	84.79	1.000	.00	348.00	5.34	.0219	.65-	.183	
233	004	0023	2	2	00	197.58	1079.6	.728	249.39	1.000	.00	.00	7.54	.0309	.19	.295-	
233	004	0024	2	2	00	195.99	1079.6	.722	74.30	1.000	.00	1.99	6.60	.0271	.53-	.075-	
233	004	0025	2	2	00	196.25	1079.6	.723	89.32	1.000	.00	3.99	5.26	.0216	1.40-	.200	
233	004	0026	2	2	00	194.99	1079.6	.718	85.62	1.000	.00	5.99	4.60	.0188	1.55-	.312	
233	004	0029	2	2	00	223.84	1250.5	.753	82.18	1.200	.00	.00	8.00	.0283	.38-	.372-	
233	004	0030	2	2	00	221.01	1250.5	.744	86.50	1.200	.00	1.99	7.21	.0255	.96-	.193-	
233	004	0031	2	2	00	220.47	1250.5	.742	87.16	1.200	.00	3.99	6.33	.0224	.54-	.011-	
233	004	0032	2	2	00	220.68	1250.5	.743	84.06	1.200	.00	6.00	5.12	.0181	.43-	.200	
233	004	0033	2	2	00	221.72	1250.5	.746	300.08	1.200	.00	357.99	7.99	.0283	.18	.376-	
233	004	0034	2	2	00	218.43	1250.5	.735	77.73	1.200	.00	356.00	7.10	.0251	.23-	.171-	
233	004	0035	2	2	00	221.59	1250.5	.746	100.50	1.200	.00	353.99	5.67	.0201	.91-	.113	
233	004	0036	2	2	00	221.47	1250.5	.745	89.16	1.200	.00	352.01	4.26	.0151	1.34-	.323	
233	004	0037	2	2	00	220.68	1250.5	.743	69.85	1.200	.00	349.99	3.48	.0123	1.28-	.411	
233	004	0038	2	2	00	221.13	1250.5	.744	91.44	1.200	.00	348.00	3.64	.0129	1.47-	.398	

PRELIMINARY

NATIONAL AERONAUTICS AND
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SID-62-1065

Appendix "A"

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PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA
233	005	0030	20	2	00	875.28	1250.5	2.947	84.90	1.200	.00	359.99	9.80	.0347	.73-	.221-
233	005	0031	20	2	00	875.45	1250.5	2.948	76.39	1.200	.00	1.99	8.78	.0311	1.12-	.153-
233	005	0032	20	2	00	875.49	1250.5	2.948	91.94	1.200	.00	3.00	8.06	.0285	.88-	.097-
233	005	0033	20	2	00	875.62	1250.5	2.948	89.02	1.200	.00	4.00	6.70	.0237	.66-	.020-
233	005	0034	20	2	00	875.49	1250.5	2.948	48.63	1.200	.00	4.99	4.47	.0158	.45-	.070
233	005	0035	20	2	00	875.33	1250.5	2.947	176.34	1.200	.00	6.00	2.10	.0074	.73-	.221
233	005	0036	20	2	00	875.20	1250.5	2.947	111.01	1.200	.00	358.00	10.58	.0375	.17-	.278-
233	005	0037	20	2	00	875.45	1250.5	2.948	279.80	1.200	.00	356.00	9.48	.0336	.21	.196-
233	005	0038	20	2	00	875.28	1250.5	2.947	76.07	1.200	.00	354.00	3.62	.0128	.52-	.102
233	005	0039	20	2	00	875.74	1250.5	2.949	24.87	1.200	.00	355.00	7.53	.0267	.03-	.066-
233	005	0042	20	2	00	779.38	1079.6	2.873	261.67	1.000	.00	359.98	11.43	.0469	.25	.395-
233	005	0043	20	2	00	779.31	1079.6	2.872	76.45	1.000	.00	2.00	7.92	.0325	.75-	.106-
233	005	0044	20	2	00	779.56	1079.6	2.873	129.37	1.000	.00	4.00	3.49	.0143	11.45-	.255
233	005	0045	20	2	00	779.45	1079.6	2.873	136.11	1.000	.00	4.00	3.36	.0138	9.44-	.259
233	005	0046	20	2	00	778.97	1079.6	2.871	282.52	1.000	.00	.00	11.30	.0464	.21	.387-
233	005	0047	20	2	00	779.64	1079.6	2.874	289.39	1.000	.00	358.00	10.37	.0425	.45	.303-
233	005	0048	20	2	00	779.56	1079.6	2.873	41.14	1.000	.00	356.00	5.21	.0214	.41-	.045
233	005	0049	20	2	00	779.45	1079.6	2.873	158.80	1.000	.00	354.00	2.10	.0086	10.32-	.383
233	005	0052	20	2	00	744.33	790.0	3.498	58.28	.700	.00	.00	7.15	.0401	.17-	.056-
233	005	0053	20	2	00	744.50	790.0	3.498	65.43	.700	.00	1.00	6.25	.0350	.40-	.003-
233	005	0054	20	2	00	743.93	790.0	3.496	91.30	.700	.00	2.00	3.40	.0190	.92-	.129
233	005	0055	20	2	00	742.82	790.0	3.490	39.61	.700	.00	358.01	5.04	.0282	.31-	.055
233	005	0056	20	2	00	743.51	790.0	3.494	145.27	.700	.00	357.00	2.25	.0126	1.28-	.182
233	005	0057	20	2	00	743.91	790.0	3.496	156.51	.700	.00	357.00	2.12	.0118	.88-	.185
233	005	0058	20	2	00	742.94	790.0	3.491	101.23	.700	.00	.00	7.05	.0395	.19-	.044-
233	005	0059	20	2	00	742.82	790.0	3.490	67.13	.700	.00	.00	7.06	.0396	.27-	.050-
233	005	0060	20	2	00	742.70	790.0	3.490	65.95	.700	.00	.00	7.05	.0395	.20-	.048-

PRELIMINARY

NATIONAL AERONAUTICS AND
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Appendix "A"

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PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA	
233	006	0013	12	2	00	877.86	1250.5	2.956	128.53	1.200	.00	150.00	7.61	.0269	.13-	.010	NASA
233	006	0014	12	2	00	877.36	1250.5	2.954	273.08	1.200	.00	154.00	8.18	.0290	.48	.016-	Langley Research Center
233	006	0015	12	2	00	876.91	1250.5	2.953	269.00	1.200	.00	152.01	8.28	.0293	1.71	.019-	Langley Station
233	006	0016	12	2	00	876.86	1250.5	2.952	301.62	1.200	.00	150.00	7.63	.0270	.19	.003	Hampton, Virginia
233	006	0017	12	2	00	878.15	1250.5	2.957	271.04	1.200	.00	148.00	8.93	.0316	3.29	.050-	
233	006	0018	12	2	00	879.03	1250.5	2.960	268.50	1.200	.00	146.00	8.08	.0286	3.02	.009-	
233	006	0019	12	2	00	876.49	1250.5	2.951	276.99	1.200	.00	144.00	5.31	.0188	1.86	.078	
233	006	0020	12	2	00	876.66	1250.5	2.952	276.47	1.200	.00	143.00	3.32	.0117	1.64	.124	
233	006	0023	12	2	00	779.71	1079.6	2.874	254.76	1.000	.00	150.00	8.20	.0336	.60	.013-	
233	006	0024	12	2	00	779.71	1079.6	2.874	273.37	1.000	.00	153.99	8.68	.0356	.97	.043-	
233	006	0025	12	2	00	779.93	1079.6	2.875	48.40	1.000	.00	152.00	7.75	.0318	.44-	.010-	
233	006	0026	12	2	00	779.90	1079.6	2.875	285.72	1.000	.00	149.99	8.31	.0341	.77	.031-	
233	006	0027	12	2	00	780.49	1079.6	2.877	278.79	1.000	.00	148.00	8.73	.0358	.86	.049-	
233	006	0028	12	2	00	780.12	1079.6	2.875	322.59	1.000	.00	145.99	8.33	.0342	.23	.035-	
233	006	0029	12	2	00	779.82	1079.6	2.874	265.11	1.000	.00	143.99	8.11	.0333	.15	.013-	
233	006	0030	12	2	00	781.23	1079.6	2.879	263.26	1.000	.00	141.99	7.31	.0300	.35	.022	
233	006	0031	12	2	00	782.30	1079.6	2.883	359.74	1.000	.00	140.00	4.69	.0192	.00	.109	
233	006	0032	12	2	00	779.93	1079.6	2.875	164.58	1.000	.00	137.99	2.04	.0083	.39-	.174	
233	006	0035	12	2	00	742.10	790.0	3.487	267.95	.700	.00	150.00	10.74	.0602	2.48	.159-	
233	006	0036	12	2	00	741.19	790.0	3.483	269.77	.700	.00	154.00	9.10	.0510	.89	.066-	
233	006	0037	12	2	00	742.45	790.0	3.489	269.67	.700	.00	152.01	9.02	.0506	1.00	.061-	
233	006	0038	12	2	00	741.73	790.0	3.485	269.53	.700	.00	150.01	11.43	.0641	2.14	.209-	
233	006	0039	12	2	00	742.45	790.0	3.489	271.40	.700	.00	148.00	12.74	.0715	2.50	.310-	
233	006	0040	12	2	00	743.46	790.0	3.494	268.99	.700	.00	146.00	10.53	.0591	1.36	.149-	
233	006	0041	12	2	00	744.25	790.0	3.497	271.07	.700	.00	144.00	6.96	.0390	.79	.036	
233	006	0042	12	2	00	742.30	790.0	3.488	293.18	.700	.00	142.01	3.92	.0220	.45	.132	
233	006	0043	12	2	00	743.24	790.0	3.492	280.99	.700	.00	142.99	5.31	.0298	.32	.096	
233	006	0044	12	2	00	741.68	790.0	3.485	281.64	.700	.00	145.00	8.77	.0492	1.06	.059-	
233	006	0045	12	2	00	740.22	790.0	3.478	268.69	.700	.00	150.00	11.55	.0648	2.32	.216-	

PRELIMINARY

NATIONAL AERONAUTICS AND
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Appendix "A"

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PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CNR	CNB
233	007	0007	10	4	00	740.52	790.0	3.480	309.98	.700	.00	150.00	14.87	.0834	.04	2.842
233	007	0008	10	4	00	739.83	790.0	3.476	267.77	.700	.00	154.00	14.78	.0829	.07	2.805
233	007	0009	10	4	00	740.02	790.0	3.477	265.15	.700	.00	152.00	14.82	.0831	.09	2.820
233	007	0010	10	4	00	741.58	790.0	3.485	294.59	.700	.00	150.00	14.94	.0838	.01	2.864
233	007	0011	10	4	00	740.25	790.0	3.478	270.66	.700	.00	148.01	14.89	.0835	.17	2.848
233	007	0012	10	4	00	740.96	790.0	3.482	273.29	.700	.00	146.00	14.68	.0823	.32	2.762
233	007	0013	10	4	00	741.19	790.0	3.483	269.34	.700	.00	144.00	15.22	.0854	.14	2.980
233	007	0014	10	4	00	740.99	790.0	3.482	75.22	.700	.00	142.00	14.74	.0827	.04-	2.785
233	007	0015	10	4	00	740.69	790.0	3.481	65.07	.700	.00	140.00	14.50	.0813	.05-	2.692
233	007	0016	10	4	00	740.59	790.0	3.480	87.92	.700	.00	138.00	14.35	.0805	.11-	2.631
233	007	0017	10	4	00	740.72	790.0	3.481	117.86	.700	.00	136.01	14.19	.0796	.03-	2.567
233	007	0020	10	4	00	251.51	351.6	2.506	272.80	.300	.00	150.00	13.53	.1706	.19	6.829
233	007	0021	10	4	00	251.54	351.6	2.506	270.73	.300	.00	154.00	13.52	.1704	.28	6.816
233	007	0022	10	4	00	251.53	351.6	2.506	253.50	.300	.00	152.00	13.53	.1706	.19	6.817
233	007	0023	10	4	00	251.50	351.6	2.506	270.89	.300	.00	150.00	13.63	.1718	.25	6.938
233	007	0024	10	4	00	251.45	351.6	2.505	271.38	.300	.00	148.01	13.55	.1708	.31	6.852
233	007	0025	10	4	00	251.41	351.6	2.505	267.27	.300	.00	146.00	13.49	.1701	.16	6.785
233	007	0026	10	4	00	251.39	351.6	2.505	282.44	.300	.00	144.01	13.20	.1664	.09	6.479
233	007	0027	10	4	00	251.27	351.6	2.503	276.20	.300	.00	142.01	12.87	.1623	.03	6.132
233	007	0028	10	4	00	251.22	351.6	2.503	89.03	.300	.00	140.00	12.69	.1600	.13-	5.948
233	007	0030	10	4	00	251.17	351.6	2.502	62.28	.300	.00	138.00	12.74	.1606	.03-	6.002
233	007	0031	10	4	00	250.83	351.6	2.499	84.22	.300	.00	136.01	12.68	.1599	.06-	5.947
233	007	0034	10	4	00	708.33	987.4	2.783	264.43	.900	.00	150.00	14.27	.0640	.05	2.718
233	007	0035	10	4	00	708.27	987.4	2.783	43.64	.900	.00	154.00	14.34	.0644	.01-	2.747
233	007	0036	10	4	00	708.43	987.4	2.784	246.91	.900	.00	152.01	14.35	.0644	.01	2.750
233	007	0037	10	4	00	709.61	987.4	2.788	268.86	.900	.00	150.01	14.44	.0648	.02	2.783
233	007	0038	10	4	00	708.23	987.4	2.783	118.87	.900	.00	148.00	14.41	.0647	.06-	2.774
233	007	0039	10	4	00	707.93	987.4	2.782	88.93	.900	.00	146.01	14.41	.0647	.03-	2.777
233	007	0040	10	4	00	709.98	987.4	2.790	94.09	.900	.00	144.01	14.48	.0650	.05-	2.798
233	007	0041	10	4	00	708.00	987.4	2.782	88.86	.900	.00	142.00	14.34	.0644	.03-	2.748
233	007	0042	10	4	00	708.03	987.4	2.782	94.17	.900	.00	140.00	14.40	.0646	.05-	2.772
233	007	0043	10	4	00	708.37	987.4	2.783	278.40	.900	.00	138.01	14.38	.0645	.01	2.763
233	007	0044	10	4	00	708.00	987.4	2.782	302.76	.900	.00	136.00	14.52	.0652	.00	2.823
233	007	0047	10	4	00	783.08	1079.6	2.886	93.22	1.000	.00	150.00	14.53	.0596	.08-	2.555
233	007	0048	10	4	00	783.52	1079.6	2.888	25.25	1.000	.00	154.00	14.53	.0596	.01-	2.555
233	007	0049	10	4	00	783.67	1079.6	2.888	290.82	1.000	.00	152.00	14.54	.0597	.02	2.558
233	007	0050	10	4	00	783.34	1079.6	2.887	170.79	1.000	.00	150.01	14.60	.0599	.01-	2.578
233	007	0051	10	4	00	784.11	1079.6	2.890	95.25	1.000	.00	148.00	14.49	.0595	.05-	2.537
233	007	0052	10	4	00	783.63	1079.6	2.888	70.29	1.000	.00	146.00	14.47	.0594	.02-	2.531
233	007	0053	10	4	00	784.59	1079.6	2.892	80.67	1.000	.00	144.01	14.58	.0598	.04-	2.570
233	007	0054	10	4	00	785.41	1079.6	2.895	81.68	1.000	.00	142.01	14.55	.0597	.05-	2.556
233	007	0055	10	4	00	787.11	1079.6	2.901	88.86	1.000	.00	140.00	14.62	.0600	.06-	2.576
233	007	0056	10	4	00	785.07	1079.6	2.894	88.86	1.000	.00	138.00	14.84	.0609	.01-	2.666
233	007	0057	10	4	00	784.85	1079.6	2.893	104.92	1.000	.00	136.00	14.42	.0592	.04-	2.508
233	007	0061	10	4	00	882.64	1250.5	2.972	88.86	1.200	.00	154.01	14.66	.0519	.01-	2.311

SID-62-1065
Appendix "A"

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PRELIMINARY
NATIONAL AERONAUTICS AND
SPACE ADMINISTRATION

[REDACTED]

PRJ	RUN	POINT	CONF	I	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CNR	CNB	
233	007	0062		10	4	00	884.35	1250.5	2.978	87.13	1.200	.00	152.01	14.69	.0520	.14-	2.317
233	007	0063		10	4	00	886.38	1250.5	2.984	81.82	1.200	.00	150.00	14.72	.0522	.03-	2.321
233	007	0064		10	4	00	884.93	1250.5	2.980	89.07	1.200	.00	148.01	14.76	.0523	.01-	2.338
233	007	0065		10	4	00	881.23	1250.5	2.967	89.07	1.200	.00	146.01	14.88	.0527	.04-	2.389
233	007	0066		10	4	00	880.85	1250.5	2.966	89.07	1.200	.00	144.00	14.77	.0523	.04-	2.353
233	007	0067		10	4	00	880.11	1250.5	2.963	94.83	1.200	.00	142.00	14.57	.0516	.04-	2.287
233	007	0068		10	4	00	878.28	1250.5	2.957	80.19	1.200	.00	140.01	14.36	.0509	.06-	2.222
233	007	0069		10	4	00	878.28	1250.5	2.957	86.77	1.200	.00	138.01	13.96	.0495	.11-	2.091
233	007	0070		10	4	00	880.56	1250.5	2.965	89.01	1.200	.00	136.00	14.08	.0499	.05-	2.124
233	007	0071		10	4	00	878.24	1250.5	2.957	89.07	1.200	.00	150.00	14.66	.0519	.04-	2.322

NASA
Langley Research Center
Langley Station
Hampton, Virginia

PRELIMINARY

NATIONAL AERONAUTICS AND
SPACE ADMINISTRATION

SID-62-1065

Appendix "A"

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PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA	
233	008	0033	11	2	00	877.53	1250.5	2.955	268.75	1.200	.00	150.00	10.80	.0382	.27	.042-	NASA
233	008	0034	11	2	00	875.41	1250.5	2.947	271.67	1.200	.00	152.00	10.46	.0370	.72	.031-	Langley Research Center
233	008	0035	11	2	00	875.24	1250.5	2.947	294.84	1.200	.00	154.01	10.50	.0372	.05	.033-	Langley Station
233	008	0036	11	2	00	875.41	1250.5	2.947	271.42	1.200	.00	148.01	11.33	.0401	1.80	.064-	Hampton, Virginia
233	008	0038	11	2	00	878.11	1250.5	2.957	266.13	1.200	.00	146.01	10.39	.0368	.97	.025-	
233	008	0039	11	2	00	877.07	1250.5	2.953	278.18	1.200	.00	144.00	8.25	.0292	.40	.037	
233	008	0040	11	2	00	876.03	1250.5	2.950	210.21	1.200	.00	141.99	4.92	.0174	.03	.114	
233	008	0041	11	2	00	875.33	1250.5	2.947	172.01	1.200	.00	141.01	1.97	.0069	.42-	.167	
233	008	0044	11	2	00	778.60	1079.6	2.870	314.83	1.000	.00	150.00	10.53	.0432	.20	.046-	
233	008	0045	11	2	00	778.34	1079.6	2.869	280.60	1.000	.00	152.01	10.68	.0438	.12	.044-	
233	008	0046	11	2	00	778.42	1079.6	2.869	273.03	1.000	.00	154.00	10.88	.0446	.16	.051-	
233	008	0048	11	2	00	741.31	790.0	3.483	272.58	.700	.00	150.00	13.09	.0734	1.82	.165-	
233	008	0049	11	2	00	741.46	790.0	3.484	272.04	.700	.00	152.00	11.38	.0638	.56	.077-	
233	008	0050	11	2	00	741.04	790.0	3.482	281.99	.700	.00	154.00	10.86	.0609	.76	.063-	
233	008	0051	11	2	00	741.71	790.0	3.485	270.57	.700	.00	149.99	13.80	.0774	1.48	.198-	
233	008	0052	11	2	00	743.09	790.0	3.492	280.48	.700	.00	147.99	12.48	.0700	1.19	.143-	
233	008	0053	11	2	00	742.65	790.0	3.490	256.32	.700	.00	145.99	11.09	.0622	.26	.058-	
233	008	0054	11	2	00	741.93	790.0	3.486	271.53	.700	.00	143.99	10.19	.0571	.60	.025-	
233	008	0055	11	2	00	742.20	790.0	3.488	268.84	.700	.00	141.99	9.82	.0551	1.18	.008-	
233	008	0056	11	2	00	741.58	790.0	3.485	279.98	.700	.00	139.99	7.43	.0417	.23	.069	
233	008	0057	11	2	00	741.31	790.0	3.483	304.07	.700	.00	139.00	6.41	.0359	.13	.096	
233	008	0058	11	2	00	743.12	790.0	3.492	.35	.700	.00	137.99	6.08	.0341	.01-	.106	
233	008	0059	11	2	00	741.24	790.0	3.483	333.93	.700	.00	136.99	5.56	.0312	.04	.116	
233	008	0060	11	2	00	740.94	790.0	3.482	.49	.700	.00	135.99	5.01	.0281	.01-	.128	
233	008	0061	11	2	00	742.47	790.0	3.489	270.39	.700	.00	149.98	13.48	.0756	1.62	.180-	

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PRJ	RUN	PCINT	CONF	T	S	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA
233	009	0014	3	2	00	711.58	987.4	2.796	89.92	.900	.00	352.00	12.27	.0551	.18-	.011
233	009	0015	3	2	00	710.91	987.4	2.793	88.99	.900	.00	347.99	12.05	.0541	.20-	.017
233	009	0016	3	2	00	711.75	987.4	2.797	92.39	.900	.00	349.99	12.07	.0542	.20-	.017
233	009	0017	3	2	00	711.38	987.4	2.795	94.21	.900	.00	351.99	12.29	.0551	.23-	.011
233	009	0018	3	2	00	712.96	987.4	2.801	95.99	.900	.00	353.99	12.60	.0565	.08-	.001
233	009	0019	3	2	00	713.53	987.4	2.804	77.43	.900	.00	355.99	12.67	.0569	.11-	.002-
233	009	0020	3	2	00	710.98	987.4	2.794	87.07	.900	.00	357.99	12.83	.0576	.17-	.006-
233	009	0021	3	2	00	711.08	987.4	2.794	89.01	.900	.00	359.99	13.05	.0586	.19-	.013-
233	009	0022	3	2	00	710.88	987.4	2.793	85.96	.900	.00	2.00	13.16	.0591	.16-	.017-
233	009	0023	3	2	00	713.33	987.4	2.803	89.86	.900	.00	4.00	13.37	.0600	.11-	.023-
233	009	0024	3	2	00	711.25	987.4	2.795	86.27	.900	.00	6.00	13.49	.0605	.04-	.027-
233	009	0027	3	2	00	742.94	790.0	3.491	83.97	.700	.00	352.00	13.04	.0731	.08-	.012-
233	009	0028	3	2	00	743.29	790.0	3.493	75.30	.700	.00	348.00	12.26	.0688	.18-	.007
233	009	0029	3	2	00	742.89	790.0	3.491	87.04	.700	.00	350.00	12.62	.0708	.14-	.000-
233	009	0030	3	2	00	741.58	790.0	3.485	268.60	.700	.00	351.99	12.97	.0728	.14	.009-
233	009	0031	3	2	00	742.23	790.0	3.488	85.34	.700	.00	353.99	13.30	.0746	.08-	.020-
233	009	0032	3	2	00	742.65	790.0	3.490	98.49	.700	.00	356.00	13.44	.0754	.06-	.023-
233	009	0033	3	2	00	742.55	790.0	3.489	87.06	.700	.00	358.00	13.50	.0757	.06-	.026-
233	009	0034	3	2	00	744.10	790.0	3.497	78.36	.700	.00	359.99	12.93	.0725	.14-	.010-
233	009	0035	3	2	00	744.25	790.0	3.497	78.72	.700	.00	1.99	12.88	.0722	.09-	.008-
233	009	0036	3	2	00	743.86	790.0	3.495	78.72	.700	.00	4.00	13.05	.0732	.08-	.013-
233	009	0037	3	2	00	741.98	790.0	3.487	309.85	.700	.00	5.99	14.07	.0789	.02	.046-
233	009	0040	3	2	00	251.09	351.6	2.502	261.57	.300	.00	352.00	13.20	.1664	.07	.048-
233	009	0041	3	2	00	251.32	351.6	2.504	282.58	.300	.00	348.00	13.07	.1648	.01	.039-
233	009	0042	3	2	00	252.93	351.6	2.520	272.43	.300	.00	349.99	13.79	.1739	.12	.106-
233	009	0043	3	2	00	251.19	351.6	2.503	262.85	.300	.00	351.99	13.25	.1670	.05	.054-
233	009	0045	3	2	00	250.82	351.6	2.499	270.00	.300	.00	354.00	12.88	.1624	.07	.021-
233	009	0046	3	2	00	251.28	351.6	2.504	272.61	.300	.00	356.00	12.85	.1620	.04	.019-
233	009	0047	3	2	00	250.88	351.6	2.500	106.52	.300	.00	357.99	12.75	.1607	.03-	.008-
233	009	0048	3	2	00	251.25	351.6	2.503	90.00	.300	.00	.00	12.54	.1581	.10-	.008
233	009	0049	3	2	00	251.00	351.6	2.501	84.37	.300	.00	2.00	12.42	.1566	.10-	.017
233	009	0050	3	2	00	250.93	351.6	2.500	293.64	.300	.00	4.00	13.00	.1639	.03	.034-
233	009	0051	3	2	00	251.11	351.6	2.502	274.43	.300	.00	6.00	13.21	.1665	.09	.052-
233	009	0054	3	2	00	871.50	1250.5	2.934	273.52	1.200	.00	352.00	12.26	.0434	.16	.009
233	009	0055	3	2	00	871.63	1250.5	2.935	89.92	1.200	.00	348.01	11.72	.0415	.08-	.022
233	009	0056	3	2	00	871.54	1250.5	2.934	79.65	1.200	.00	350.01	11.68	.0414	.11-	.022
233	009	0057	3	2	00	871.88	1250.5	2.936	279.42	1.200	.00	352.01	12.26	.0434	.06	.008
233	009	0058	3	2	00	872.33	1250.5	2.937	359.92	1.200	.00	354.00	11.89	.0421	.00	.018
233	009	0059	3	2	00	871.38	1250.5	2.934	84.19	1.200	.00	356.01	12.28	.0435	.10-	.008
233	009	0060	3	2	00	865.68	1250.5	2.915	82.30	1.200	.00	358.01	12.33	.0437	.15-	.006
233	009	0061	3	2	00	875.87	1250.5	2.949	80.43	1.200	.00	.01	12.58	.0446	.17-	.000
233	009	0062	3	2	00	874.74	1250.5	2.945	77.35	1.200	.00	2.01	12.71	.0450	.17-	.003-
233	009	0063	3	2	00	879.11	1250.5	2.960	82.77	1.200	.00	4.01	12.85	.0455	.23-	.006-
233	009	0064	3	2	00	879.57	1250.5	2.961	87.19	1.200	.00	6.00	13.26	.0470	.19-	.016-
233	009	0067	3	2	00	780.16	1079.6	2.875	81.23	1.000	.00	352.00	12.17	.0499	.31-	.010

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PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA
233	009	0068	3	2	00	778.27	1079.6	2.869	83.42	1.000	.00	348.00	11.89	.0488	.18-	.019
233	009	0069	3	2	00	778.64	1079.6	2.870	73.67	1.000	.00	349.99	12.22	.0501	.09-	.010
233	009	0070	3	2	00	778.27	1079.6	2.869	76.06	1.000	.00	352.00	12.17	.0499	.18-	.010
233	009	0071	3	2	00	777.97	1079.6	2.867	86.82	1.000	.00	353.99	12.36	.0507	.21-	.007
233	009	0072	3	2	00	779.86	1079.6	2.874	77.78	1.000	.00	356.00	12.49	.0513	.12-	.002
233	009	0073	3	2	00	777.97	1079.6	2.867	86.78	1.000	.00	357.99	12.69	.0521	.20-	.002-
233	009	0074	3	2	00	777.97	1079.6	2.867	86.41	1.000	.00	.00	12.95	.0531	.13-	.009-
233	009	0075	3	2	00	778.16	1079.6	2.868	87.05	1.000	.00	2.00	12.97	.0532	.18-	.010-
233	009	0076	3	2	00	778.90	1079.6	2.871	83.32	1.000	.00	4.00	13.12	.0538	.11-	.014-
233	009	0077	3	2	00	778.01	1079.6	2.868	68.81	1.000	.00	6.00	13.29	.0545	.11-	.021-

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Appendix "A"
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APPENDIX "B"

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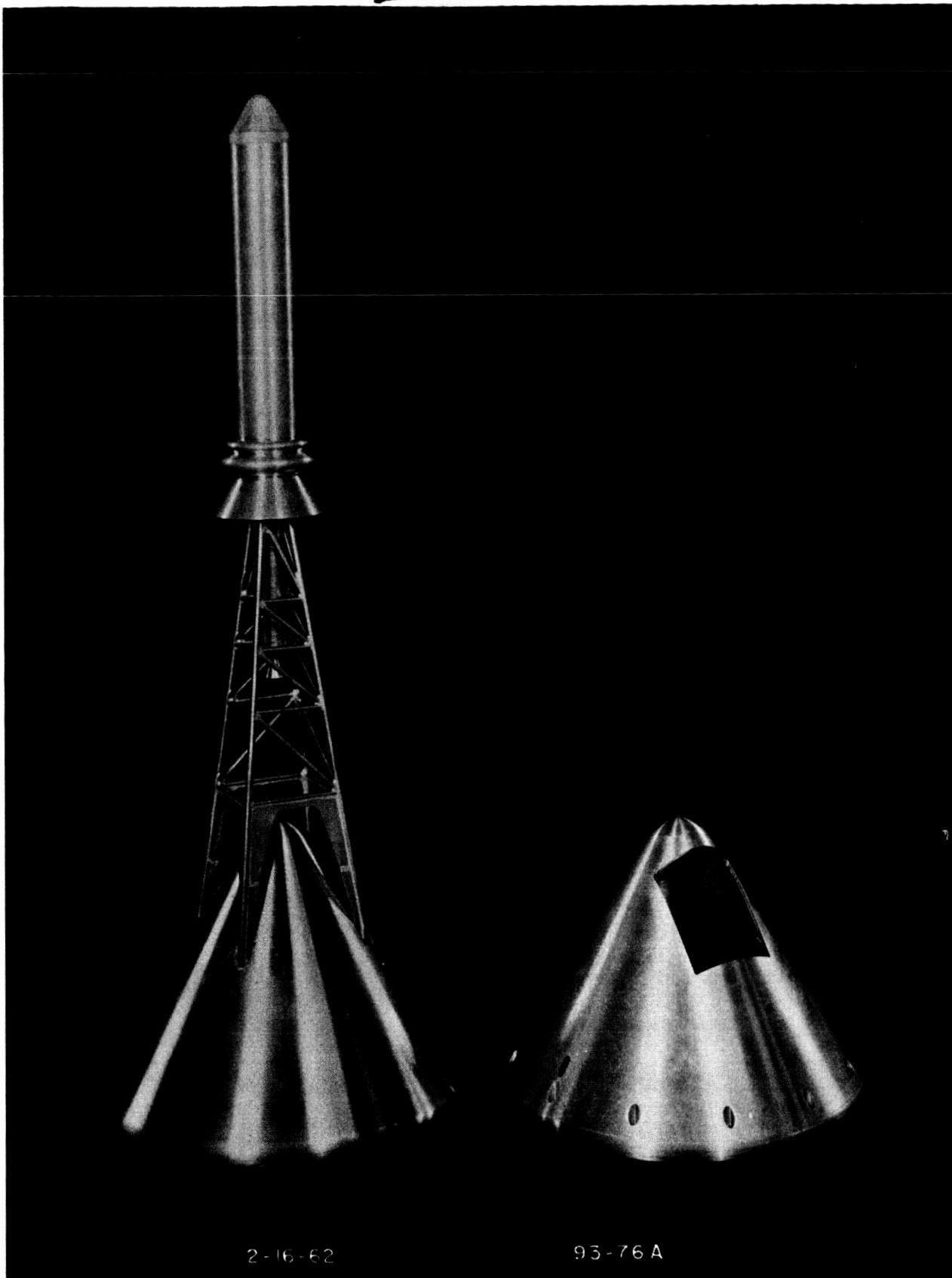
SID-62-1065
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<u>Dynamic Stability Parameters-Oscillation in Yaw</u> Mach = 0.30 to 1.20		
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Fig. 1 Launch Escape Config. (ET12C) & Command Module (C)
Note: Only Configuration E4T12C was tested
(Same as above with toroid tanks on escape rocket removed)

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SPACE and INFORMATION SYSTEMS DIVISION

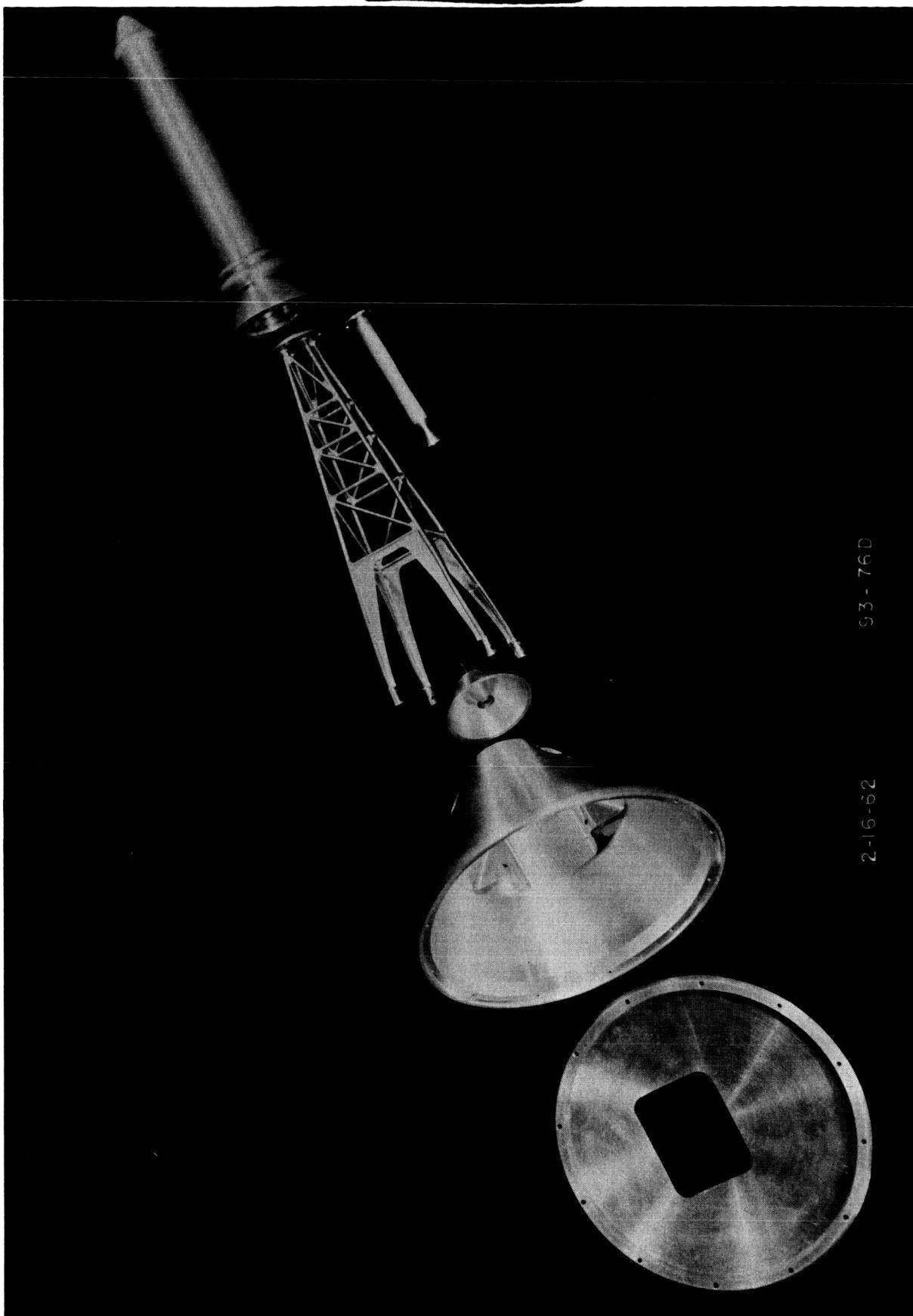


Fig. 2 Launch Escape Config. (ET12C), Model Assembly

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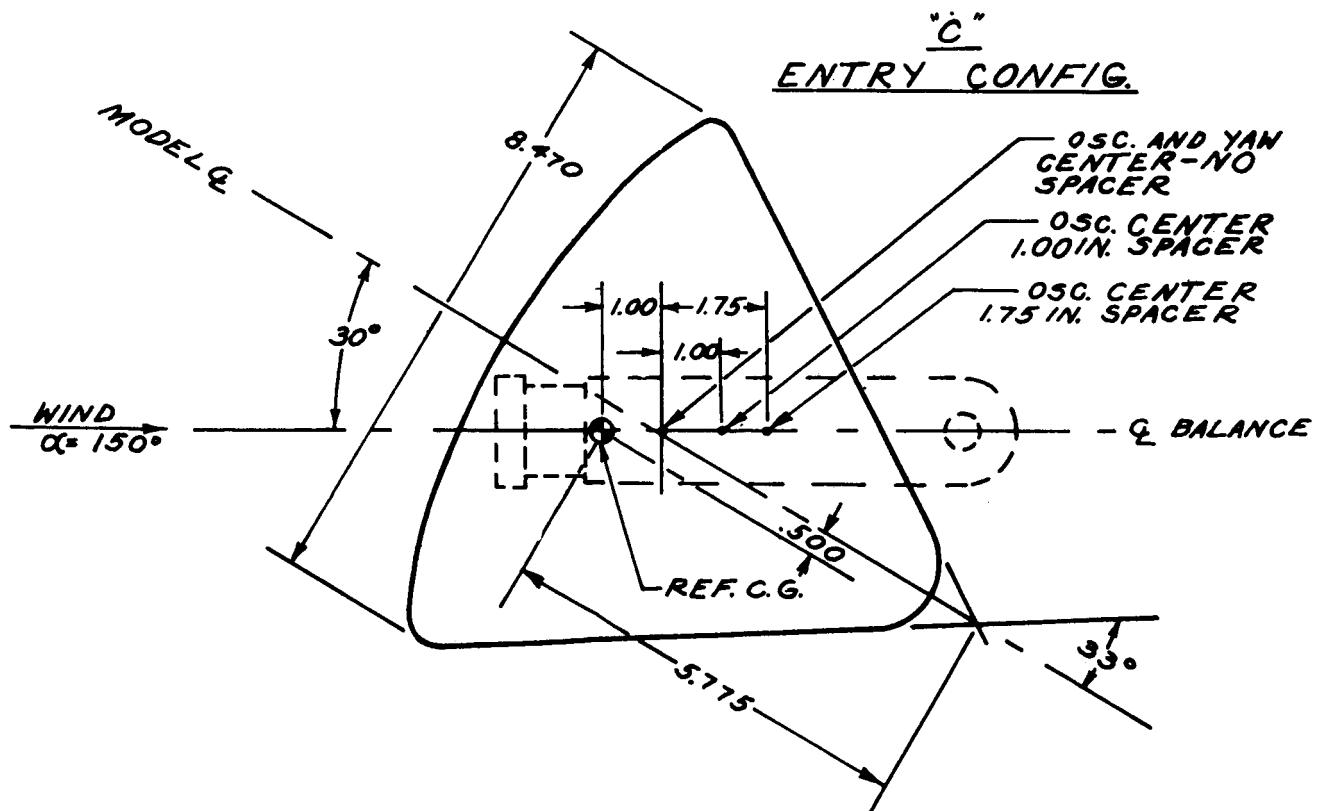
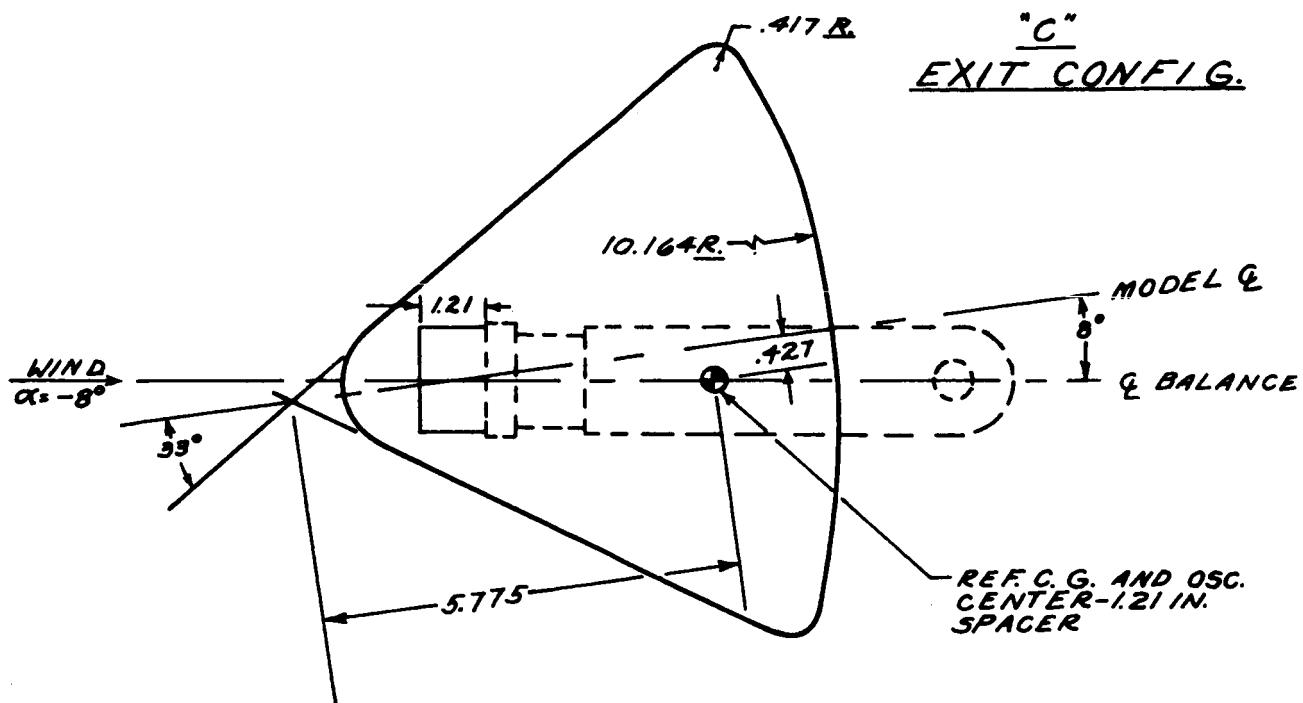
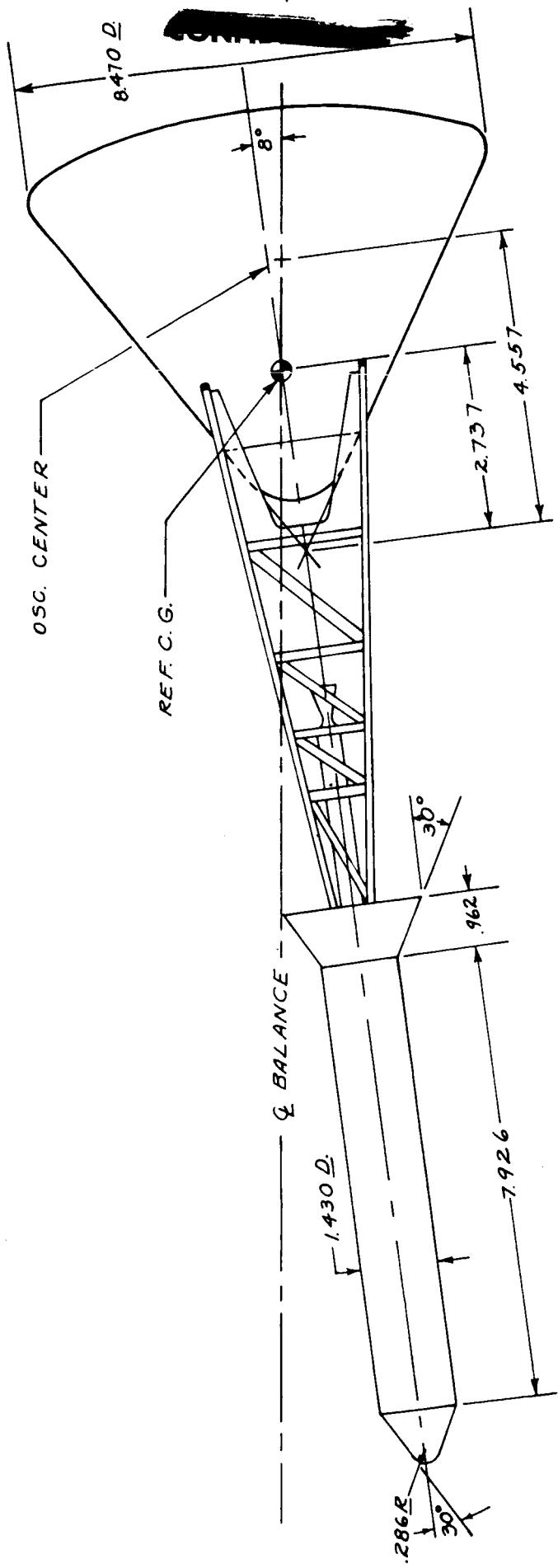


FIG. 3 - COMMAND MODULE OSCILLATION CENTER LOCATION

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LAUNCH ESCAPE CONFIGURATION, E₄ T₂ C₂
N.A. DWG. 7121-0/058

ALL DIMENSIONS IN INCHES

FIG. 4 - LAUNCH ESCAPE CONFIG. OSCILLATION CENTER LOCATION

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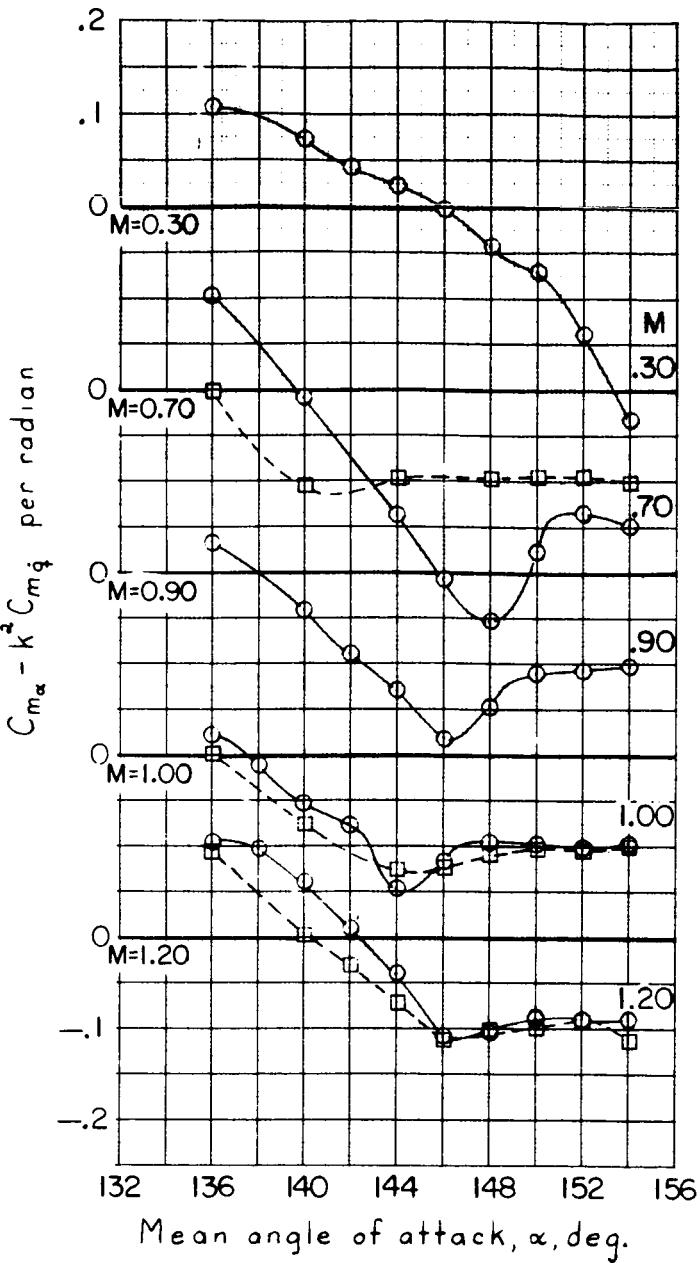
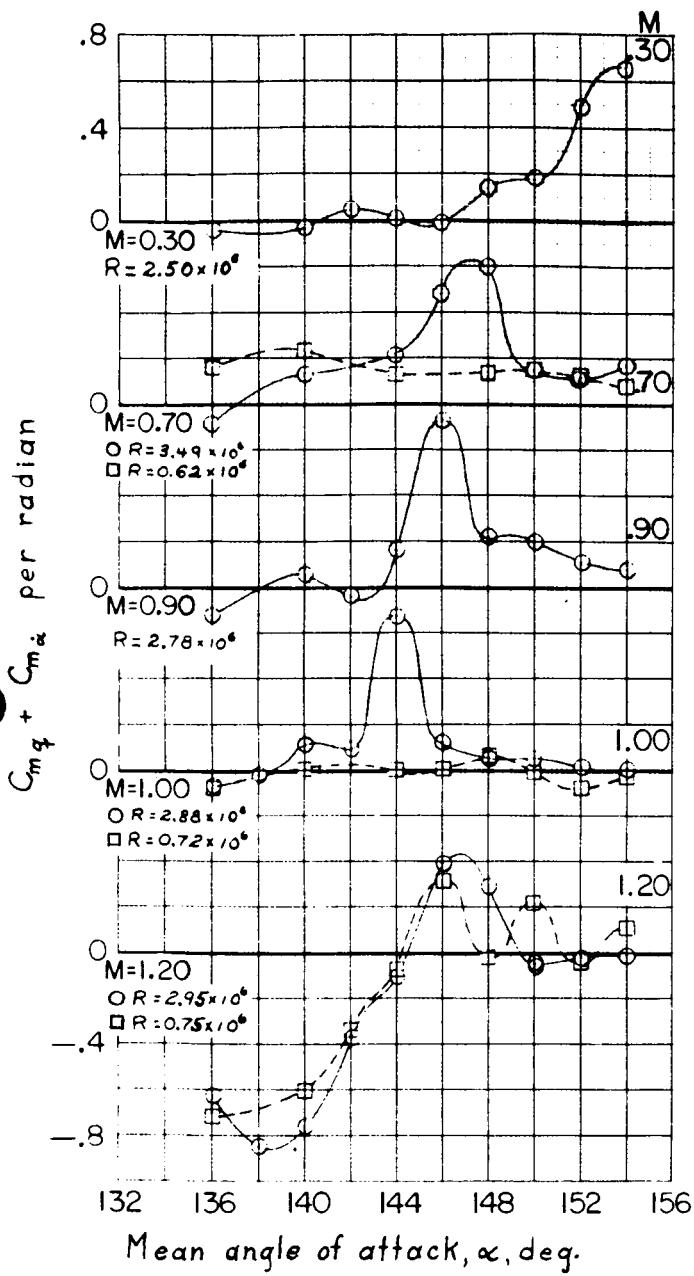


Figure 5 : Variation of the damping-in-pitch parameter and the oscillatory longitudinal stability parameter with mean angle of attack for the model of the _ entry configuration. (Runs 1 & 2) (No spacer)

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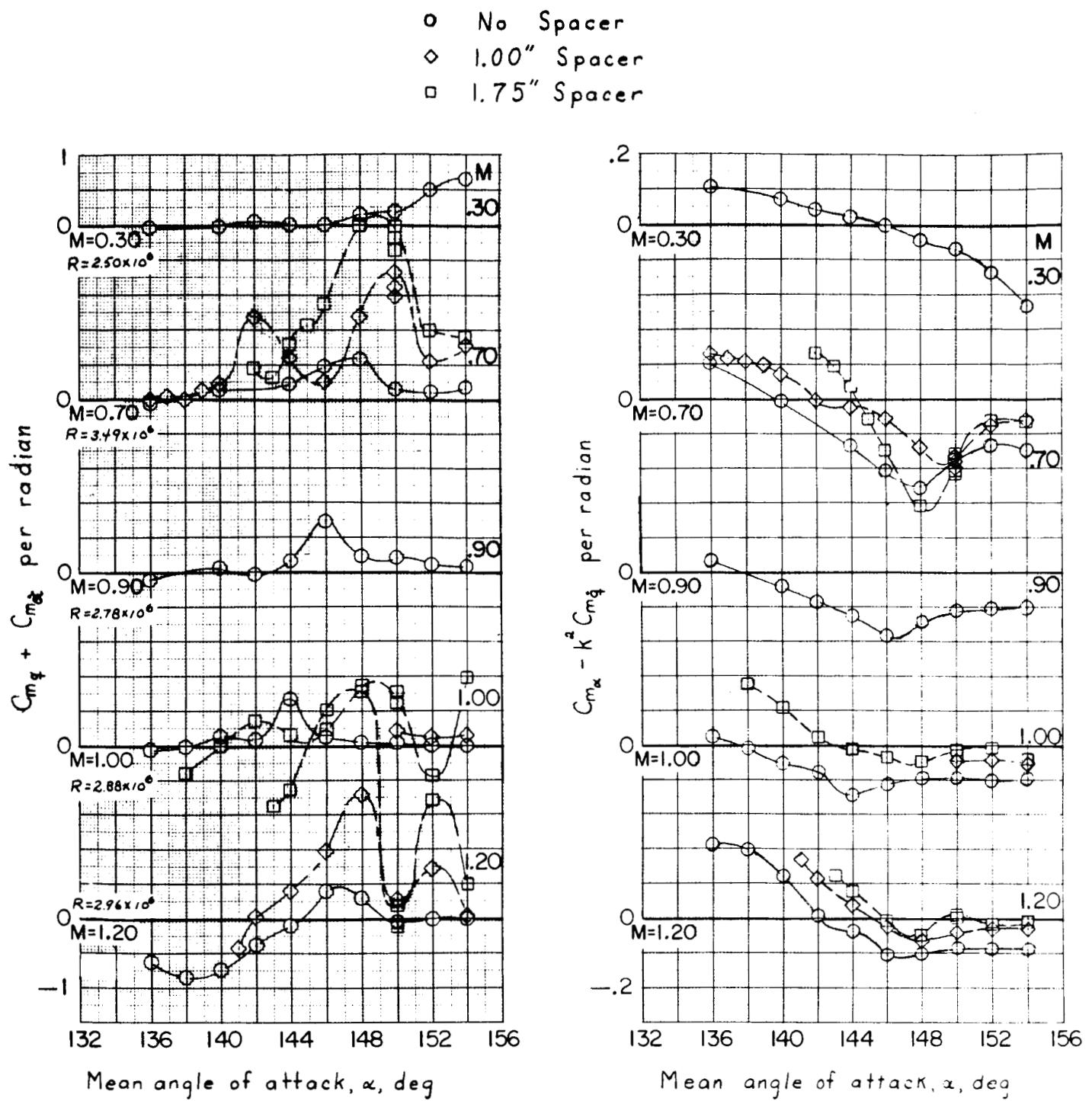


Figure 6: Variation of the damping-in-pitch parameter and the oscillatory longitudinal stability parameter with mean angle of attack for the model of the entry configuration. (Runs 1, 6 & 8)

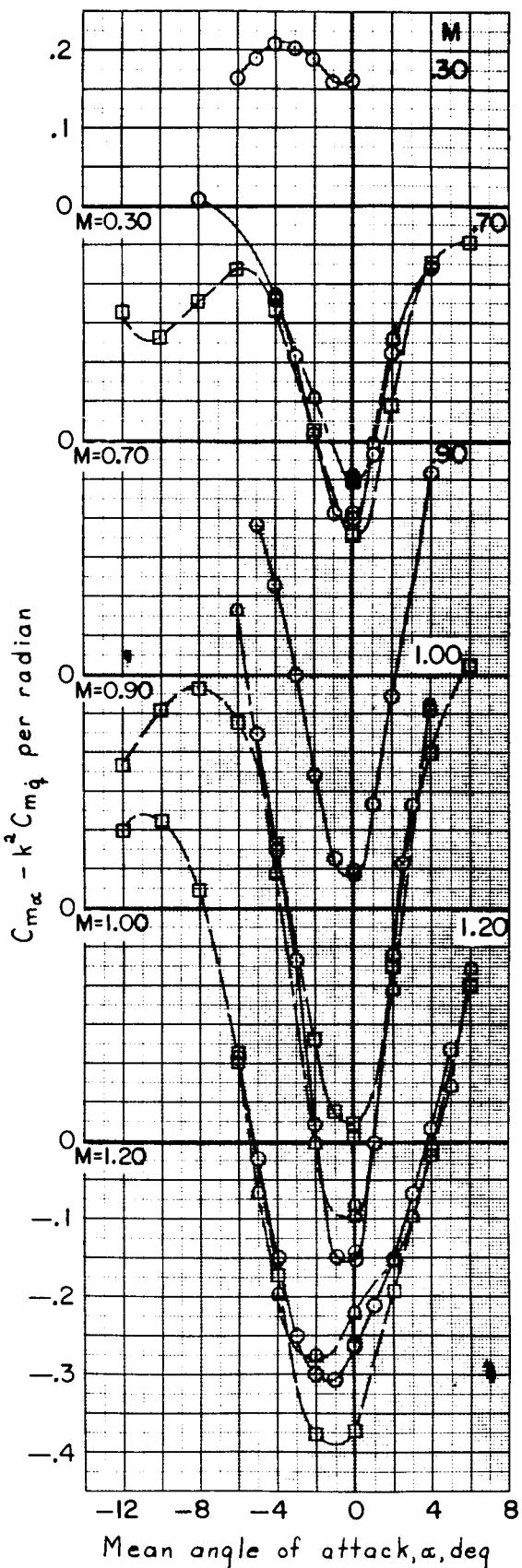
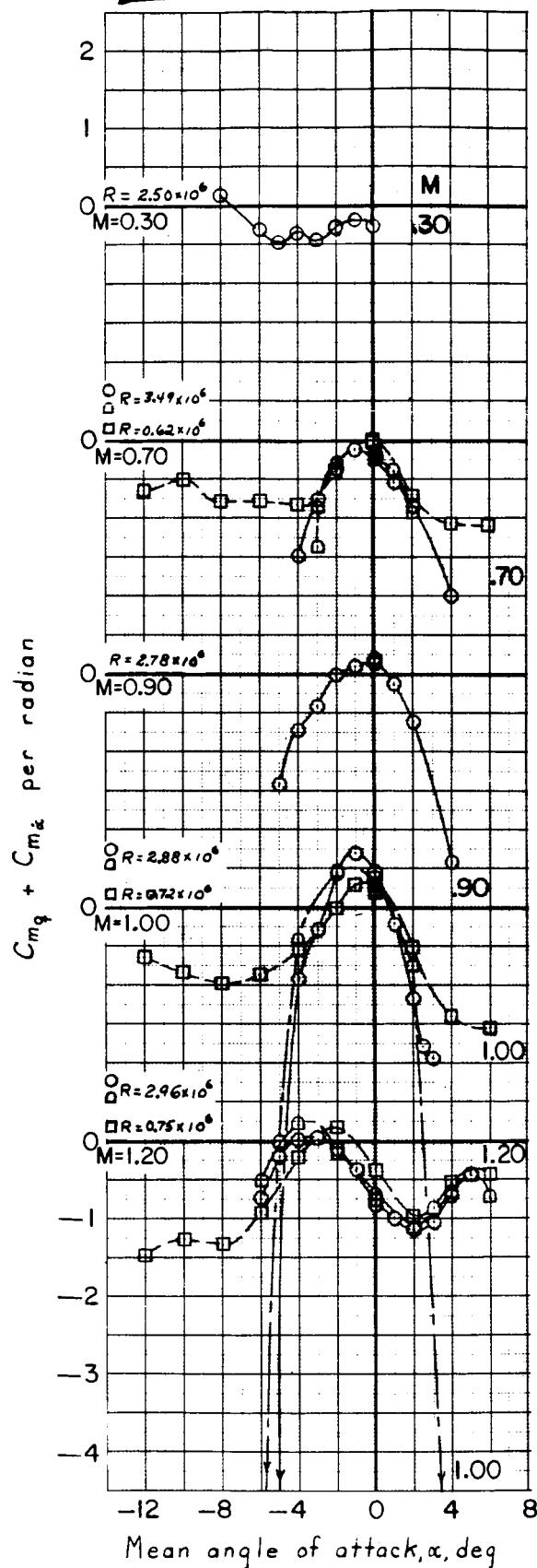
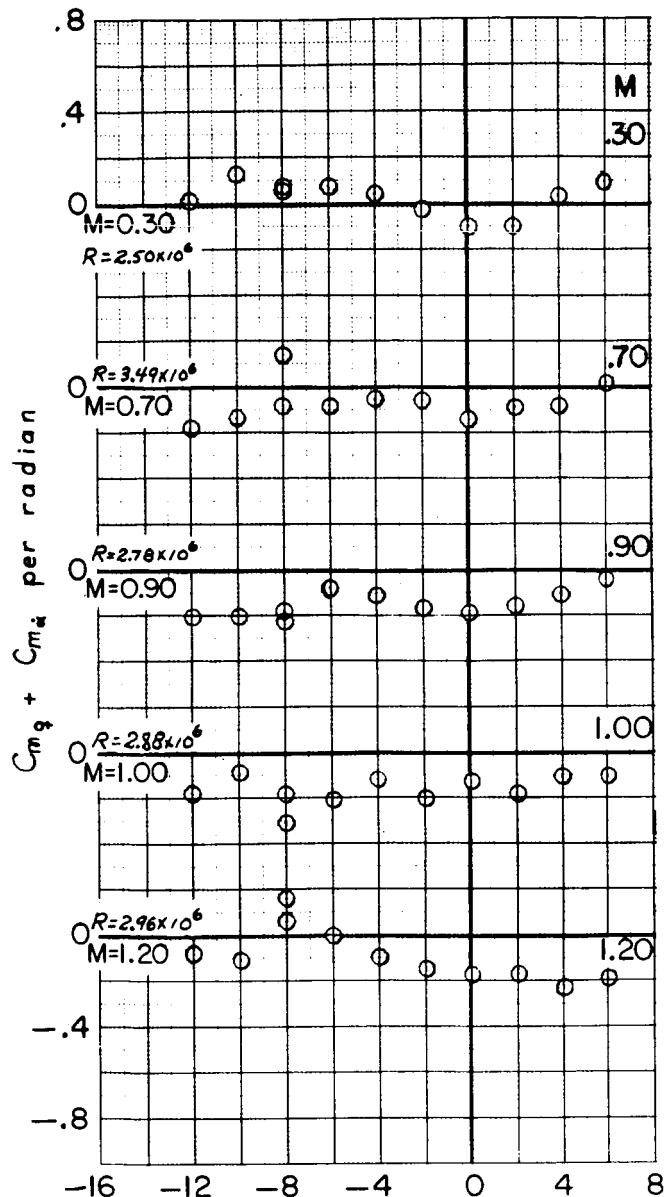
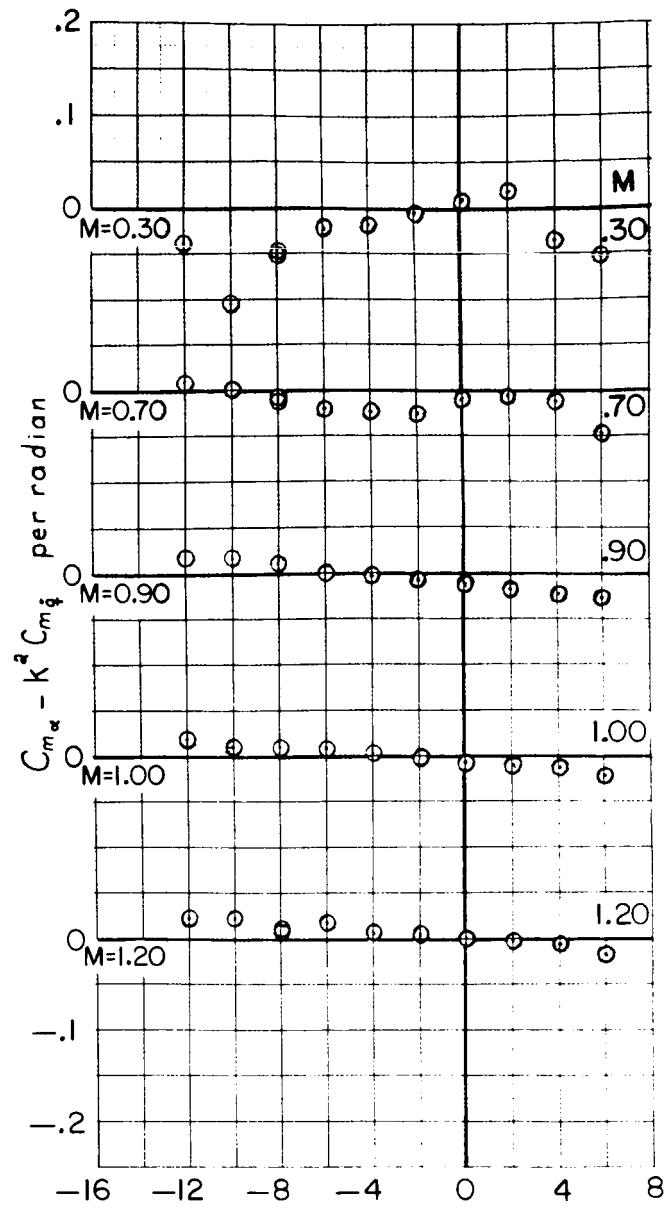


Figure 7: Variation of the damping-in-pitch parameter and the oscillatory longitudinal stability parameter with mean angle of attack for the model of the launch escape configuration. (Runs 3, 4 & 5) (Data for the model with dummy balance cover on command module apex is indicated by the symbol, \circ)

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Mean angle of attack, α , deg.



Mean angle of attack, α , deg.

Figure 8: Variation of the damping-in-pitch parameter and the oscillatory longitudinal stability parameter with mean angle of attack for the model of the command module with heat shield aft. (Run 9) (Exit configuration)

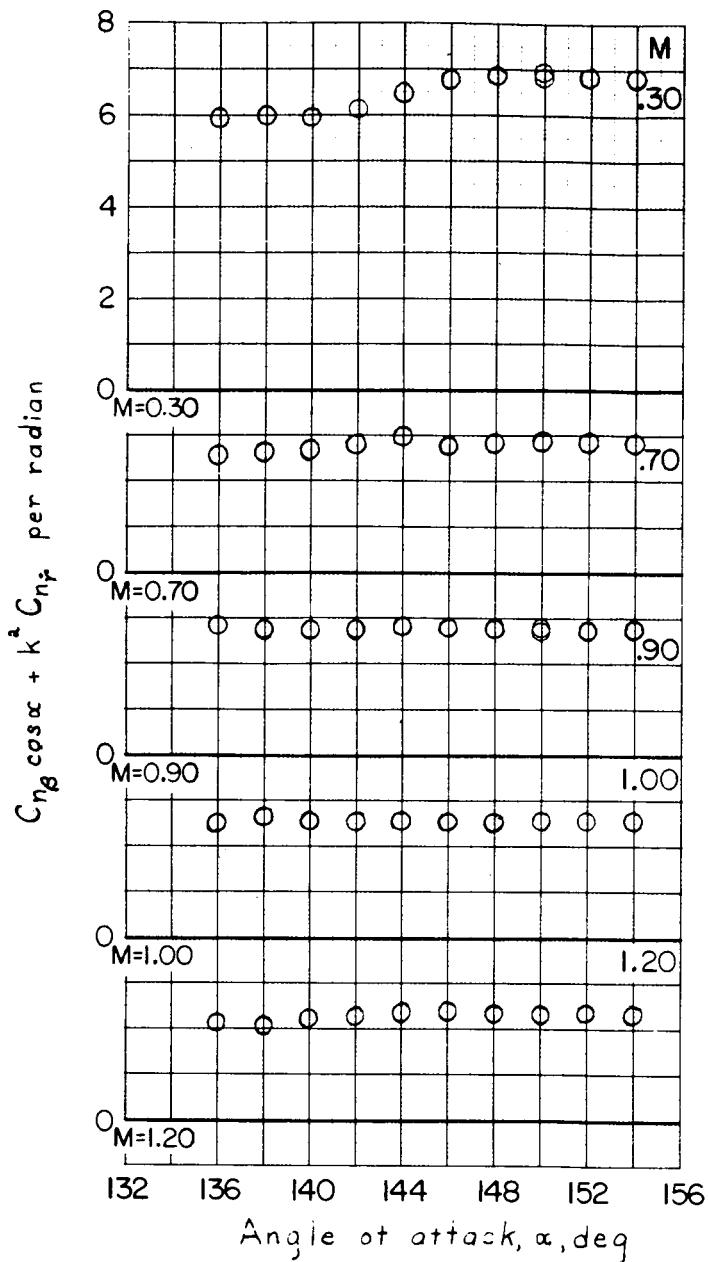
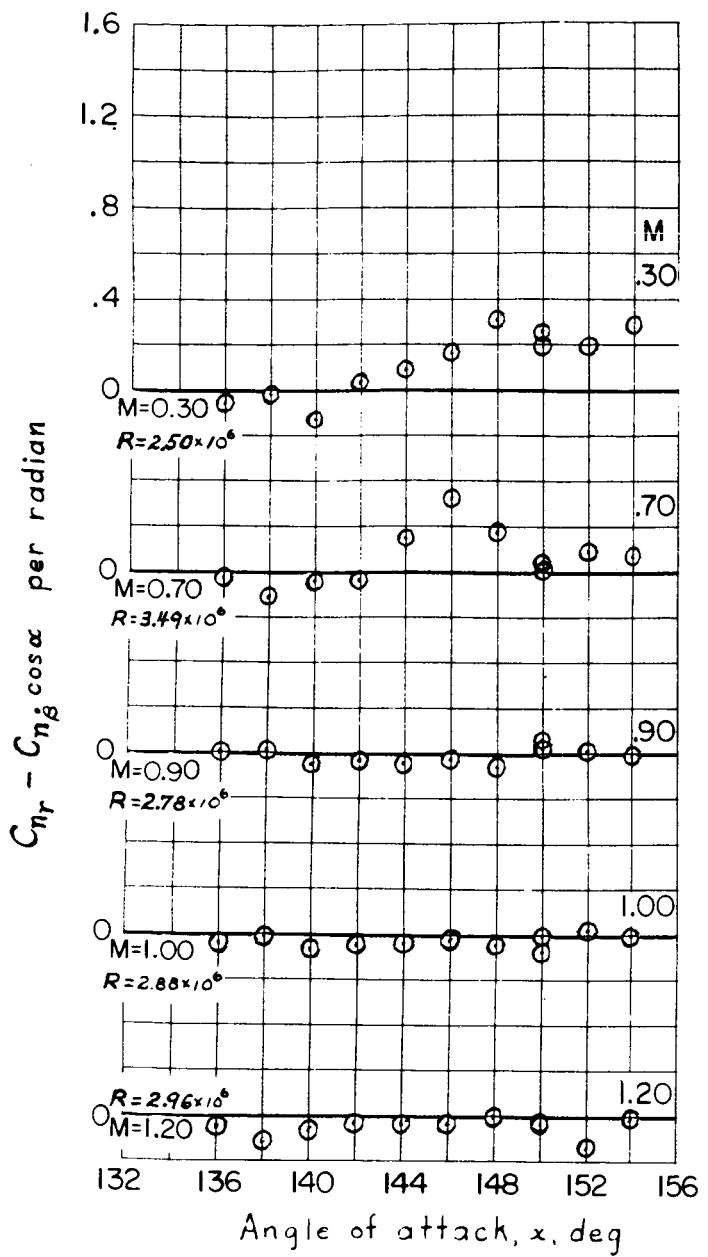


Figure 9: Variation of the damping-in-yaw parameter and the oscillatory directional stability parameter with angle of attack for the entry configuration. (Run 7)